C&E-Team Projects
COEN/COSC/ELEN 4920 and 4998
2/2/2018

C40: (Direct Supply) Internet of Things – Connected clinical Devices

The purpose of this project will be to build an interface between a clinical measurement device and a small data collector that will be used to save and store readings from the device. The data that is collected will be used to do basic analysis and trends of the readings.

- The connected clinical measurement device will be a Pulse Oximeter that has a Bluetooth connection. This device will be provided by Direct Supply for the duration of the project. A Pulse Oximeter records pulse rate and O2 levels of a test subject.
- The computer system for the data collection will be a Raspberry Pi, Arduino, or a similar small processor. This is being done to support future delivery of the solution as a small embedded controller.
- The design team will use the readings that are taken to analyze conditions that impact pulse rate and O2 levels. Direct Supply wants to understand if there is any correlation between age, time-of-day, mood, and stress levels and the readings taken with the Pulse Oximeter.

Sponsor: Kent Newbury, Direct Supply
Faculty advisor: Dr. Richard Povinelli
Team composition: Zhou Shen, Franco Reda, Ryan Clulo and Samuel Norris

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C45: Desktop application for GASDAY

The project involves building a desktop application for the GasDay lab. GasDay generates natural gas demand forecasts over an eight-day period allowing Local Distribution Companies (LDCs) time to plan their supply for the week. Recent research efforts in the lab have found a way to characterize the "health" of the model, meaning the performance of the forecasts relative to the actual data provided by the LDC.

Issues in the model come from two different sources of errors, verification and validation failure. Verification failures are categorized as a misinterpretation of data. Validation failures are categorized as systems that no longer accurately represent what is actually happening in reality.

My goal is to create an application that can be used internally to allow teams in the lab to proactively monitor the forecasting models to identify and correct the errors before the customer calls us to tell us.

Currently, weeks can go by before a customer identifies and notifies us about inaccuracies in the model, this project would potentially save customers of those inaccuracies in a proactive manner instead of a reactive one.

Outside of creating this application for internal use, we would also add the "health monitor" to the web application customers currently use to see their forecasts. Customers would then be provided immediate feedback on data they enter into the web application.

Sponsor: Jim Reilly, GASDAY LAB
Faculty advisor: Dr. George Corliss
Team composition: Jim Reilly, James Drenovsky, Jashive Quintas and Justin Furst.

C46: Enhancing Parallel Processing Using GPU Clusters

Basic Terminology/Concepts:

- Parallel Processing: A type of computer operation in which a process is split into various parts that are executed simultaneously on different processors. These processors are attached to the same computer.
- Graphics Processing Unit (GPU): A specialized electronic circuit that is primarily used to output information onto a display device (such as a computer monitor). As a necessity, the hardware is designed to rapidly manipulate and alter memory in order to accelerate the creation of the images.
    - Modern GPUs are designed to be efficient at manipulating computer graphics and image processing.
    - They have a highly parallel structure (which goes hand-in-hand with parallel processing). This makes them more efficient than a regular processor when it comes to processing large amounts of data for algorithms.

Project Background:

Due to the various properties of GPUs, they are used in parallel processing. This combination of both hardware and software is further used to rapidly and efficiently perform vast amounts of calculations that are based on large sets of data. Consequently, the advantage that comes with this ability can be demonstrated in scenarios where it is necessary to perform such calculations near real-time. One such potential application is for a medical device software that is designed to be used for physical therapy.

Objective:

The objective is to use Nvidia GPU clusters in order to perform large-scale calculations that are very close to real-time. As a result, this device can output diagnostic information pertaining to a patient that is undergoing physical therapy. The computing platform/programming model used to

write code for the GPU clusters is called CUDA. The base language used to code is yet to be decided but will most likely be either C or Python.

Sponsor: Michael Bachmann
Faculty advisor: Dr. Satish Puri
Team composition: Chandan Matta, Matt Kinzler, Liam Jonas and Timothy Buente

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C48: Biometric Authentication for Digital Personal Assistants

A personal assistant such as Amazon Echo promises a friendlier user experience than a computing device like a laptop or a smartphone. Voice activated commands are the main tool through which this promise is delivered. Developers often avoid adding authentication mechanisms to new skills for Alexa [1], which could be due to the cumbersome nature of password-based mechanisms for user-friendly devices. In this project, students will develop a skill for Amazon's Alexa that authenticates based on biometrics. The team will explore face recognition algorithms and will use them in accordance with the camera of Amazon Echo Show, a device introduced in the summer 2017. The students will conduct an initial assessment of their authentication mechanism for accuracy and usability.

[1] Alhadlaq, Abdulaziz, Jun Tang, Aleksandra Korolova, and Marwan Almaymoni. "Privacy in the Amazon Alexa Skills Ecosystem." Star 217 (1902): 11. Available at: https://petsymposium.org/2017/papers/hotpets/amazon-alexa-skills-ecosystem-privacy.pdf

Sponsor and Faculty advisor: Dr. Debbie Perouli
Team composition: Vashti Marin and Joseph Marotta

E52: Room Sensor network

The objective of this project is to build a Proof-of-concept sensor network in a room that detects location of user(s) and adjusts a feature (e.g. lighting, music) based on their location. The team will explore which sensing technologies are best for detecting the location of user(s) in a room and create a design to integrate the sensor network into the room.

Sponsor: Eric Plate, Kohler Company
Faculty advisor: Dr. Thomas Schwarz
Team composition: Vincent Zornow, Kevin Banky, Kevyn Schwab, Adam Kobiela, Brian Stumph and Sunny Patel.

E55: Water Usage Data Synthesis

The objective of this project is to build a Proof-of-concept that takes water usage data and synthesizes it in a dashboard or its equivalent. The team will explore what technologies could be used to sense water usage for home products and develop a system to combine the water usage data to provide valuable insights to the homeowner.

Sponsor: Eric Plate, Kohler Company
Faculty advisor: Dr. Thomas Schwarz
Team composition: Thomas Hicks, James Markvart, Alex Dawson, Matthew Mogenson and Rene Mercado

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E60: SolarDash: Android dashboard for a solar car

The goal of this project is to develop a scalable dashboard for a solar car prototype. The dashboard is an app that can be run on a smart phone or a tablet and will be developed for Android devices. The purpose of this app is to retrieve wirelessly information from several critical components of the car including: temperatures of main PV panels, speed of the car, battery and motor(s) status, etc. This information is displayed on the main dashboard of the app. The app has also the ability to send wirelessly controls to the car. The controls include commands for steering, speed control, emergency stop, etc.

Design Objectives: The following are the main steps.
1. Decide about the type of information to be collected and displayed as well as the number and type of controls. Decide about wireless technologies to be used.
2. Develop the hardware set-up for testing, using an existing solar car prototype developed in 2016- 2017.
3. Develop the Android app. Test and verify it on a smart phone and on a tablet.
4. Maintain a project website.

Project Prerequisites: Experience with Android programming, embedded systems, WiFi and/or Bluetooth wireless technologies. Hands on experience with embedded systems hardware. Students should be self-motivated to learn new interdisciplinary approaches that bridge knowledge and skills from Android programming, embedded systems, power electronics, DC motors, mechanical engineering, and system integration.

Sponsor: Dr. Cris Ababei
Faculty advisor: Dr. Cris Ababei
Team composition: Kathleen Baert, Alexander Luczak and Jeremy cook

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E61: Elder care for their mental wellness as a companion

Elderly people and people suffering from mental illness often requires constant help and monitoring. Our goal is to program a robot that would act as a constant companion for the elderly

person, be it at home, or in an old home. The robot would be able to pick up sound and physiological data from the wearable. Using proximity sensors it should be able to move towards the subject to interact and intervene if necessary.

Sponsor: Dr. Sheikh Iqbal Ahamed and Tanvir Roushan (Ubicomp lab)
Faculty advisor: Dr. Sheikh Iqbal Ahamed
Team composition: Glenn Brown, Zachary Burk, Catherine Martin, Michael Panetta and Alaa Shanaa

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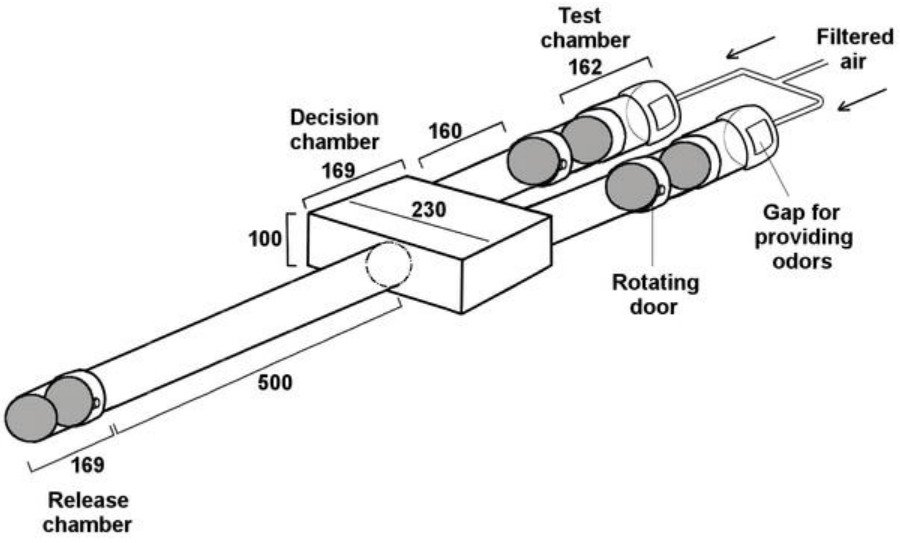
E62: Smelly socks project- Fighting Malaria one Smelly sock at a time

Project Background: With nearly half the world's population at risk of malaria, the need for malaria-transmitting mosquito research remains at an all-time high. By analyzing mosquito flight tendencies in relation to their olfaction senses being stimulated, scientists are able to determine how different smells attract potential malaria-infected mosquitos to humans. Described below is a three step project designed to allow a team of students to feasibly create a device that tests the response levels of mosquito olfaction sense stimulation as well as digitally collect relating data that can be later used for other analysis. Upon conclusion of the semester, it is expected that students have applied quality contributions to the project however will not be penalized in the event of incompletion. Additionally, this projects poses as a great use of technical and mechanical skills and would give the team members the experience needed to attract potential employers.

Project Description: *(Part I)* Design and construct an olfactometer (smell machine) to test mosquito response levels in different controlled experiments. The machine can be kept relatively simple however must follow the general guidelines of the olfactometer below:



(Part 2) Implement the use of sensors within the olfactometer to automatically log the amount of mosquitos flying into either test chamber. There are no restrictions on sensors/cameras used for detection. Data collected must be logged and stored in an easily accessible way.

(Part 3) Automatically log data collected in part 2 on a web-based application to preset data in a helpful and usable way. Preferably, the data should be logged to the live web-based application for immediate use.

Project Sponsors: "Ifakara Health Institute (IHI) is a leading research organization in Africa, with strong track records in developing, testing and validating innovations for health. We are driven by core strategic mandate for *research, training and services.* The institute's work spans across a wide spectrum of sciences including biomedical and ecological sciences, intervention studies, health-systems research, monitoring and evaluation and policy translation. IHI has a history of more than 50 years. It is an independent non-profit organization registered in Tanzania"

Marquette holds close ties with the Ifakara Health Institute along with a good working relationship to conduct a senior design project. Dr. Samson Kiware, a Marquette graduate and current research scientist at IHI, will act as the project sponsor to ensure proper communication, planning, and progress is made for the Smelly Socks Project. Additionally, the faculty advisor Dr. George Corliss has partnered with IHI on projects in the past and will contribute to the cooperation between Ifakara Health Institute and Marquette University.

Sponsor: Ifakara Health Institute
Faculty advisor: Dr. George Corliss
Team composition: Cole Blazer, Damen McKay, Jake Miller, Colin Quinn Brett Van Rossum and Douglas Whitney

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E64: Universal power input device

Universal power input device that accepts any voltage, any battery, and input and converts it to clean 120VAC. This is a continuation of Briggs Powerwall project from last year.

Sponsor: Briggs and Stratton
Faculty advisor: Dr. Nathan Weise
Team composition: Matthew Deroeck, Kyle Haberkorn, Luke Haberkorn, Jeff Josse, Justin Lizalek and Dingwei Wang

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