Client/Company/Organization: Doll Distributing

Submitter Name: Lauren Doll-Sheeder Email: ldoll@dolldistributing.com

Project Contact: Lauren Doll-Sheeder Email: ldoll@dolldistributing.com

Project Title: Online ordering platform

Project Abstract:
We are looking for a solution to easier ordering for our customers, including an online ordering platform that provides customers with access to their previous orders, recent history, access to our entire portfolio with descriptions of products, etc.

Expected Deliverables:
We would like the end project to be a completed website that we can roll out to our customers so they can complete online ordering.

Specialized Resources Provided by Client:
We will provide space for them to work at our office, possible computers as well.

Anticipated Cost: Financial Resources Provided by Client: To be discussed

Preferred Students for the Project:
☐ Electrical Engineering
☑ Computer Engineering
☑ Software Engineering
☐ Other:

Other Special Skills: Be Creative

Anticipated Client Interaction (estimate):
☐ 1 meeting per week
☐ In person, ☐ Over the phone, ☐ Web / video conferencing
☐ 1 meeting per month
☐ In person, ☐ Over the phone, ☐ Web / video conferencing
☑ 2 or more meetings per month
☐ In person, ☐ Over the phone, ☑ Web / video conferencing
☐ 1 meeting per semester
☐ In person, ☐ Over the phone, ☐ Web / video conferencing

Meeting ABET Criteria

Please rate the following statements as they relate to your proposed project:

0 – Not at all  1 – A Little  2 – Somewhat  3 – A Lot  4 – Completely
On this project, students will need to apply knowledge of mathematics, science, and engineering
☐ 0  ☐ 1  ☑ 2  ☐ 3  ☐ 4

This project gives students an opportunity to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

This project involves students from a variety of programs, i.e., CprE, EE, and SE
☐ 0  ☑ 1  ☐ 2  ☐ 3  ☐ 4

This project requires students to identify, formulate, and solve engineering problems
☐ 0  ☐ 1  ☐ 2  ☑ 3  ☐ 4

This project gives students an opportunity to use the techniques, skills, and modern engineering tools necessary for engineering practice
☐ 0  ☐ 1  ☐ 2  ☑ 3  ☐ 4

---

**Project Approval – for use by ECpE Senior Design Committee**

☑ Approved:  

sddec18-proj001

☐ Project Assigned:  


☐ Advisor(s) Assigned:  


Client/Company/Organization:  Iowa State University Music Program

Submitter Name:  Tin-Shi Tam
Email: tstam@iastate.edu

Project Contact:
Email:

Project Title:
Campanile-Carillon Model

Project Abstract:
The goal of this project is to develop a 1:5 scale replica of the Iowa State Campanile and a 27-bell carillon. The Campanile-Carillon Model will be the first of its kind, which is accessible, functional, and portable. It will be used at various University events and outreach programs, off-campus recruitment and alumni events. The 27-bell carillon will serve as an educational tool and a musical instrument. The model weighs 3,000 lbs and yet will be able to travel from place to place. It will be available at all times for everyone to play a tune and to see the mechanism of the bells without having to climb hundreds of steps.

This model is a collaborative project among faculty, staff, students, alumni and friends. A multi-disciplinary academic team of faculty and students will build this model. The carillon bells will be cast professionally by reputable bell founders. ME 415/ME 466 students have been working on the structure and facade of this model since Spring 2016. Project website: http://music.iastate.edu/carillon/campmodel

Expected Deliverables:
1. Develop a tutorial "learn how to play the carillon" similar to "synthesia for piano" (http://www.synthesiagame.com) as a hands-on experience for the public to explore the instrument.

2. Design the layout for the digital display and related components, which will be used as a platform for university and organizations to present related information, display a documentary of this project and acknowledgement of donors / sponsors.

Specialized Resources Provided by Client:

Anticipated Cost: Financial Resources Provided by Client:

Preferred Students for the Project:
☑ Electrical Engineering  ☑ Other Special Skills: Music knowledge preferred, but not required.
☑ Computer Engineering  ☐ Other:
☑ Software Engineering
☐ Other:

Anticipated Client Interaction (estimate):
☑ 1 meeting per week
☑ In person, ☐ Over the phone, ☐ Web / video conferencing
Meeting ABET Criteria

Please rate the following statements as they relate to your proposed project:

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Project Approval – for use by ECpE Senior Design Committee

☑ Approved: sddec18-proj002
☐ Project Assigned: ________________________________
☐ Advisor(s) Assigned: ________________________________
Client/Company/Organization: ECPE
Submitter Name: Leland Harker
Email: leharker@iastate.edu
Project Title: Steam Heat Controller Retrofit

Project Abstract:
In a large part of Coover Hall and many other buildings on campus, steam is used for heating. Unfortunately, the only control available in many rooms is a simple rotary valve with no reference to temperature. The occupants in the rooms where this is used can experience large temperature swings throughout any given day. This project proposal is to retrofit an existing steam valve with a thermostat and valve controller. The controller should keep the room within a comfortable range. The valve control motor will be designed to be attached to an existing valve with little modification. The thermostat will be battery powered and will communicate with the valve controller wirelessly to make the installation flexible. The thermostat will implement a convenient and easy to understand human interface. The control system should be designed to be networkable as well so that the temperature could be adjusted remotely. There may be implementations where minimum and maximum temperatures could be set or energy saving scenarios during holidays could be used. The network connection would also be used to alert staff if an error was detected such as valve sticking or temperature out of range.

The project should be viewed from the possibility to be expanded to more rooms if the design could be achieved economically.

The team should expect to have a majority of the project ready to do testing during the seasons requiring heat.

Expected Deliverables:
There should be one valve controller, one thermostat and the software on each for proper control.

Specialized Resources Provided by Client:
ETG will assist with the hardware necessary for valve attachment.

Anticipated Cost: Financial Resources Provided by Client: Same as ECPE

Preferred Students for the Project:
☑ Electrical Engineering
☑ Computer Engineering
☑ Software Engineering
☐ Other: Other Special Skills: It would be useful for at least one student to have some mechanical aptitude or experience. The students should have some wireless communication experience or aptitude.

Anticipated Client Interaction (estimate):
☐ 1 meeting per week
☐ In person, ☐ Over the phone, ☐ Web / video conferencing
☐ 1 meeting per month
☐ In person, ☐ Over the phone, ☑ Web / video conferencing

☑ 2 or more meetings per month

☑ In person, ☐ Over the phone, ☑ Web / video conferencing

☐ 1 meeting per semester

☐ In person, ☐ Over the phone, ☐ Web / video conferencing

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**Meeting ABET Criteria**

Please rate the following statements as they relate to your proposed project:

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On this project, students will need to apply knowledge of mathematics, science, and engineering

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☑ 4

This project gives students an opportunity to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☑ 4

This project involves students from a variety of programs, i.e., CprE, EE, and SE

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☑ 4

This project requires students to identify, formulate, and solve engineering problems

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☑ 4

This project gives students an opportunity to use the techniques, skills, and modern engineering tools necessary for engineering practice

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☑ 4

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**Project Approval – for use by ECpE Senior Design Committee**

☑ Approved: sddec18-proj003

☐ Project Assigned: ________________________________________________

☐ Advisor(s) Assigned: ________________________________________________
Client/Company/Organization: ISU ECpE Department

Submitter Name: Daji Qiao and Long Que
Email: daji@iastate.edu

Project Title: Portable Nutrient Data Collection System - Phase III

Project Abstract:
Managing nutrients in agriculture continues to be a major challenge in ecosystem science. This project aims to design and implement a portable smartphone-based nutrient data collection system. It shall have the following components:

1) a portable device that integrates MEMS microplasma-based sensors with a low-power microcontroller, a voltage booster, and a wireless communication interface;

2) a smartphone app that
- communicates with and control the portable device via wireless communication;
- performs the functions of a spectrometer to measure the nutrient levels in water samples;
- implements a local database to manage the collected data;
- provides a friendly user interface to allow the user to have easy access to the collected data;
- communicates with a cloud server.

This is Phase III of the project. Phases I and II of the project can be accessed here: http://may1633.sd.ece.iastate.edu/ and http://may1719.sd.ece.iastate.edu/. The goal of Phase III is to improve/revise the previous designs to deliver a working prototype by April 2018.

Expected Deliverables:
Deliver a working prototype and a comprehensive final report by April 2018.

Specialized Resources Provided by Client:
Spectrometer for testing

Anticipated Cost: _________________________ Financial Resources Provided by Client: _________________________

Preferred Students for the Project:
☑ Electrical Engineering
☑ Computer Engineering
☐ Software Engineering

Other Special Skills: Prefer to have 2~3 E E students and 2~3 Cpr E students with the following skills:
MEMS Sensors
Circuit Design and Fabrication
Embedded Systems
Network Programming
Image/Video Processing Algorithms
Smartphone App Development

☐ Other:
Senior Design Project Proposal Form

Anticipated Client Interaction (estimate):

- ☑ 1 meeting per week
  - ☑ In person, ☐ Over the phone, ☐ Web / video conferencing
- ☐ 1 meeting per month
  - ☐ In person, ☐ Over the phone, ☐ Web / video conferencing
- ☐ 2 or more meetings per month
  - ☐ In person, ☐ Over the phone, ☐ Web / video conferencing
- ☐ 1 meeting per semester
  - ☐ In person, ☐ Over the phone, ☐ Web / video conferencing

Meeting ABET Criteria

Please rate the following statements as they relate to your proposed project:

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Project Approval – for use by ECpE Senior Design Committee

- ☑ Approved: sddec18-proj004
- ☐ Project Assigned: 
- ☐ Advisor(s) Assigned: 

Client/Company/Organization: SwineTech

Submitter Name: Brendon Geils
Email: bgeils@iastate.edu

Project Contact: Matthew Rooda
Email: mrooda@swinetechnologies.com

Project Title: Piglet Distress Vocalization/Squeal Recognition

Project Abstract:
A major cause of new born piglet deaths is being crushed by their mother. SwineTech has developed a product to listen for the piglets' squeal and rouse the mother freeing the piglet. While the SwineTech algorithm is about 74% effective, we want to do better. This project will utilize SwineTech hardware and implement a machine learning algorithm to identify crushing squeals faster, more accurately, and with fewer false positives. SwineTech hardware utilizes wireless communication (not used for this project) and an M4 processor. The M4 processor is a Teensy 3.2 and is Arduino compatible however the project is free to use any executive/RTOS that runs on an M4. The project will develop an algorithm that will learn piglet distress squeals and then monitor a realtime audio stream.

Expected Deliverables:
The project will deliver a paper providing a theory of operation of the algorithm, performance against a set of squeals. The project will also deliver code to both train the algorithm and execute it in real time on SwineTech hardware.

Specialized Resources Provided by Client:
SwineTech will provide initial production hardware including a microphone and ARM M4 processor for development. SwineTech will also provide recordings of piglet squeals in distress, piglet squeals not in distress, and general farrowing room sounds. SwineTech encourages the project team to visit the ISU Vet Med facilities to see a farrowing barn and the challenges of discerning a layon squeal. SwineTech will help coordinate a visit.

Anticipated Cost: SwineTech will cover costs associated with visiting the ISU farrowing facilities and cost at acquire/record squeals for use in algorithm training.

Preferred Students for the Project:
- ☐ Electrical Engineering
- ☑ Computer Engineering
- ☑ Software Engineering

Other Special Skills:
- ☑ Computer Engineering
- ☑ Software Engineering
Senior Design Project Proposal Form

☐ Other:

Anticipated Client Interaction (estimate):

☐ 1 meeting per week
   ☐ In person, ☐ Over the phone, ☑ Web / video conferencing

☑ 1 meeting per month
   ☐ In person, ☐ Over the phone, ☑ Web / video conferencing

☐ 2 or more meetings per month
   ☐ In person, ☐ Over the phone, ☐ Web / video conferencing

☐ 1 meeting per semester
   ☐ In person, ☐ Over the phone, ☑ Web / video conferencing

Meeting ABET Criteria

Please rate the following statements as they relate to your proposed project:

0 – Not at all  1 – A Little  2 – Somewhat  3 – A Lot  4 – Completely

On this project, students will need to apply knowledge of mathematics, science, and engineering ☑ 4

This project gives students an opportunity to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability ☑ 4

This project involves students from a variety of programs, i.e., CprE, EE, and SE ☑ 4

This project requires students to identify, formulate, and solve engineering problems ☑ 4

This project gives students an opportunity to use the techniques, skills, and modern engineering tools necessary for engineering practice ☑ 4

Project Approval – for use by ECpE Senior Design Committee

☑ Approved: sddec18-proj005

☐ Project Assigned: ________________________________

☐ Advisor(s) Assigned: ________________________________
Client/Company/Organization:  Iowa State University, Department of Electrical Engineering

Submitter Name:  Prof. Mani Mina   Email:  mmina@iastate.edu

Project Contact:  Neelam Prabhu Gaunkar  Email:  neelampg@iastate.edu

Project Title:  Design of a pulsed sinusoidal magnetic field generator for low-field applications

Project Abstract:
This project focuses on simulating, creating and testing magnetic fields that are applicable to low-field medical imaging systems. Pulsed magnetic fields are utilized for modulation, switching and reorientation of magnetic fields. Applying a modulation signal to a gated device can be used for generating the pulsed signals. In this project a pulsed sinusoidal signal will be generated and applied to an inductor to generate a pulsed magnetic field. The designed system will be used along with permanent magnets for low-field magnetic resonance detection.

Project goals:
The team will work towards designing and fabricating a circuit that can deliver the pulsed sinusoidal magnetic field.

Semester 1:
• Provide design approach with proof of concept prototype of circuit that can generate required magnetic field.
• Design of suitable coil geometry (surface coils or other) for transmitting and detecting the required magnetic field.

Semester 2:
• Provide a portable and operational device, fabricated to meet the required design specifications.

Design Specifications:
• Estimated magnetic flux density: 500 – 1000 Gauss
• Pulse width: 20 – 100 microseconds
• Modulation frequency: 2-10 MHz
• Current required: 10 – 100 A
• User friendly control of magnetic pulse generation

Expected Deliverables:
Semester 1: Design of coil geometry and proof of concept circuit prototype
Semester 2: Portable and operational device with appropriately shielded casing and easy control by users

Specialized Resources Provided by Client:

Anticipated Cost:  
Financial Resources Provided by Client:  

Preferred Students for the Project:

☑ Electrical Engineering
☑ Computer Engineering
☐ Software Engineering

Other Special Skills: Students with experience in circuit simulation tools such as PSpice and interest in measurements would benefit from this project.

Other: Students who have experience in power, circuits, EM, measurements

Anticipated Client Interaction (estimate):

☑ 1 meeting per week
   ✓ In person, ☐ Over the phone, ☐ Web / video conferencing
☐ 1 meeting per month
   ☐ In person, ☐ Over the phone, ☐ Web / video conferencing
☐ 2 or more meetings per month
   ☐ In person, ☐ Over the phone, ☐ Web / video conferencing
☐ 1 meeting per semester
   ☐ In person, ☐ Over the phone, ☐ Web / video conferencing

Meeting ABET Criteria

Please rate the following statements as they relate to your proposed project:

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<tr>
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Project Approval – for use by ECpE Senior Design Committee

☑ Approved: sddec18-proj006
☐ Project Assigned: 
Client/Company/Organization: Iowa State University

Submitter Name: Vikram Dalal Email: vdalal@iastate.edu

Project Title: Design and Testing of Perovskite Solar Cells

Project Abstract:
1. Design solar cell devices in perovskite materials
2. Test solar cell devices
3. Analyze the performance of devices and compare with design

Expected Deliverables:
Device design, device performance analysis

Specialized Resources Provided by Client:
will be provided by Dalal.

Anticipated Cost: ____________________________ Financial Resources Provided by Client: ____________________________

Preferred Students for the Project:
☑ Electrical Engineering
☐ Computer Engineering
☐ Software Engineering
☐ Other: Other Special Skills: EE332; EE432 or 438 preferred

Anticipated Client Interaction (estimate):
☑ 1 meeting per week
  ☑ In person, ☐ Over the phone, ☐ Web / video conferencing
☐ 1 meeting per month
  ☐ In person, ☐ Over the phone, ☐ Web / video conferencing
☐ 2 or more meetings per month
  ☐ In person, ☐ Over the phone, ☐ Web / video conferencing
☐ 1 meeting per semester
  ☐ In person, ☐ Over the phone, ☐ Web / video conferencing

Meeting ABET Criteria
Please rate the following statements as they relate to your proposed project:
On this project, students will need to apply knowledge of mathematics, science, and engineering  ☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

This project gives students an opportunity to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability  ☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

This project involves students from a variety of programs, i.e., CprE, EE, and SE  ☑ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

This project requires students to identify, formulate, and solve engineering problems  ☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

This project gives students an opportunity to use the techniques, skills, and modern engineering tools necessary for engineering practice  ☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

**Project Approval – for use by ECpE Senior Design Committee**

☑ Approved:  sddec18-proj007

☐ Project Assigned: 

☐ Advisor(s) Assigned: 

______________________________

______________________________

______________________________
Design and evaluation of reliability of many similar components by feedback

The project will design and critically evaluate a feedback approach to timing the replacement of a large number of quite similar components installed at different times to maintain reliability at minimum cost. The components will age with an increasing hazard rate. It is assumed that directly monitoring the component aging is not practical. (1) An example of such a controller will be simulated to establish feasibility. (2) If feasible, the specifications for the controller will be developed and the controller will be designed. If not feasible, we will replan the project. One expected source of variation that the controller will mitigate is changes in the installed components over time. (3) Literature will be reviewed and the feedback approach will be compared with the conventional approach of first estimating the component reliability and then designing the replacement scheme.

The simulation will use the Mathematica programming language. The project is in the systems area and students must have at least a B grade in a probability course and a control course and enthusiasm for probabilistic systems.

The deliverable is a report showing how this approach works or does not work with simulation evidence of the designed performance.

Preferred Students for the Project:

☑ Electrical Engineering
☐ Computer Engineering
☐ Software Engineering
☐ Other:

Other Special Skills: Students must have a minimum of B grade in a probability course and a controls course.

Anticipated Client Interaction (estimate):

☐ 1 meeting per week
  □ In person, □ Over the phone, □ Web / video conferencing
☐ 1 meeting per month
  □ In person, □ Over the phone, □ Web / video conferencing
☑ 2 or more meetings per month
Meeting ABET Criteria

Please rate the following statements as they relate to your proposed project:

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On this project, students will need to apply knowledge of mathematics, science, and engineering
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☑ 4

This project gives students an opportunity to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
☐ 0 ☐ 1 ☑ 2 ☐ 3 ☐ 4

This project involves students from a variety of programs, i.e., CprE, EE, and SE
☑ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4

This project requires students to identify, formulate, and solve engineering problems
☐ 0 ☐ 1 ☐ 2 ☑ 3 ☐ 4

This project gives students an opportunity to use the techniques, skills, and modern engineering tools necessary for engineering practice
☐ 0 ☐ 1 ☐ 2 ☑ 3 ☐ 4

Project Approval – for use by ECpE Senior Design Committee

☑ Approved:     sddec18-proj008
☐ Project Assigned:             
☐ Advisor(s) Assigned:         


Submitter Name: Dr. Mani Mina
Email: mmina@iastate.edu

Project Contact: Priyam Rastogi
Email: priyamr@iastate.edu

Project Title:
High current pulse generator for the application of Transcranial Magnetic Stimulation

Project Abstract:
Transcranial Magnetic Stimulation (TMS) is a non-invasive, painless treatment for the Treatment Resistant Depression (TRD). High amount of current is required for the generation of time varying magnetic field for the stimulation of the brain. TMS is based on the principal of Faraday's law. This project aims to create the TMS pulsar which will generate high current for the application of TMS.

Main goals:
1. Over the duration of two semesters, design, fabrication and testing of the TMS Pulsar.
2. Semester 1 – Early concept implementation, design, simulate, select and order the components and start the assembling parts. Programming of the micro-controller.
3. Semester 2 – Complete the assembling and test the pulsar.

Design Specifications:
1. Early concept implementation and simulation.
2. Design the circuit with high current handling components.
3. Programming of the micro-controller to control the pulsar.
4. Selecting and ordering the components.
5. Assembling of the components.
6. Testing of the Pulsar.

Expected Deliverables:
Semester 1: Early concept implementation, design, simulate, select and order the components and start the assembling parts. Programming of the micro-controller.
Semester 2: Complete the assembling and test the pulsar.

Specialized Resources Provided by Client:

Anticipated Cost: 
Financial Resources Provided by Client: 

Preferred Students for the Project:
☐ Electrical Engineering
☐ Computer Engineering
☐ Software Engineering
☐ Other:
**Senior Design Project Proposal Form**

**Anticipated Client Interaction (estimate):**

- ☑ 1 meeting per week
  - ☑ In person, ☐ Over the phone, ☐ Web / video conferencing
- ☐ 1 meeting per month
  - ☐ In person, ☐ Over the phone, ☐ Web / video conferencing
- ☐ 2 or more meetings per month
  - ☐ In person, ☐ Over the phone, ☐ Web / video conferencing
- ☐ 1 meeting per semester
  - ☐ In person, ☐ Over the phone, ☐ Web / video conferencing

**Meeting ABET Criteria**

Please rate the following statements as they relate to your proposed project:

<table>
<thead>
<tr>
<th>0 – Not at all</th>
<th>1 – A Little</th>
<th>2 – Somewhat</th>
<th>3 – A Lot</th>
<th>4 – Completely</th>
</tr>
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</table>

On this project, students will need to apply knowledge of mathematics, science, and engineering

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☑ 4

This project gives students an opportunity to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☑ 4

This project involves students from a variety of programs, i.e., CprE, EE, and SE

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☑ 4

This project requires students to identify, formulate, and solve engineering problems

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☑ 4

This project gives students an opportunity to use the techniques, skills, and modern engineering tools necessary for engineering practice

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☑ 4

**Project Approval – for use by ECpE Senior Design Committee**

- ☑ Approved: sddec18-proj009
- ☐ Project Assigned:
- ☐ Advisor(s) Assigned:
Client/Company/Organization: Christine M. Shea-Hunt

Submitter Name: Christine M. Shea-Hunt
Email: csheahunt@gmail.com

Project Title: Guardian Angel Phone Safe

Project Abstract:
Project Goal: To design and create a restrictive phone case for use in vehicles. The purpose of the phone case would be to ensure that drivers are not using/looking at their phones while driving. This is a case that would appeal to parents to give to their children and could potentially be marketed to insurance companies and/or automobile companies to promote safe driving.

The design of the case should require that user's phone be securely locked within the case prior to starting the car. The design of the case should ensure that the vehicle would be operable only after the phone is secure in the case.

My initial draft of this device involves a two sided case. Side 1 of the phone case would hold the key or key fob necessary to operate the vehicle. The driver would open Side 2 and place their cell phone in the case. When the cell phone is in place and the Side 2 door is shut and locked, Side 1 door would automatically snap open to deliver the key or key fob, thereby eliminating the use of the cell phone while driving. The phone could not be retrieved until the key/key fob is placed back into Side 1. Once the key/key fob is back in place, the door to Side 2 would open allowing access to the phone.

The design described above is a rough draft of the Guardian Angel Phone Case. Students should feel free to use their collective creativity to revise or replace the above design in any way that they see fit, assuming the end product will fulfill the project goal.

Design Constraints: The design material should be such that the screen would not be visible while driving, but bluetooth would still be accessible for those drivers with bluetooth enabled vehicles. The design should be such that the case would need to connect to or otherwise verify that the device is the driver's cell phone. This will ensure that individuals do not place benign objects in the case in order to gain access to the cell phone while driving. The materials necessary to create the case should allow an affordable end product so that every individual who would like to ensure a safe driving experience can have access to a Guardian Angel Phone Safe.

Expected Deliverables:
Students should complete a working sample of the phone case by May 2017

Specialized Resources Provided by Client:

Anticipated Cost: $500 or more if necessary

Financial Resources Provided by Client: $500 or more if necessary

Preferred Students for the Project:
Senior Design Project Proposal Form

☑ Electrical Engineering
☑ Computer Engineering
☑ Software Engineering
☐ Other:

Other Special Skills: Computer/software expertise necessary to design a case that is able to recognize the contents such the case allows access only when appropriate contents are placed in the designated side.

Anticipated Client Interaction (estimate):

☐ 1 meeting per week
☐ In person, ☐ Over the phone, ☑ Web / video conferencing

☑ 1 meeting per month
☐ In person, ☐ Over the phone, ☑ Web / video conferencing

☐ 2 or more meetings per month
☐ In person, ☐ Over the phone, ☐ Web / video conferencing

☐ 1 meeting per semester
☐ In person, ☐ Over the phone, ☑ Web / video conferencing

Meeting ABET Criteria

Please rate the following statements as they relate to your proposed project:

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On this project, students will need to apply knowledge of mathematics, science, and engineering
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☑ 4

This project gives students an opportunity to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
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☐ 0 ☐ 1 ☐ 2 ☑ 3 ☑ 4

This project gives students an opportunity to use the techniques, skills, and modern engineering tools necessary for engineering practice
☐ 0 ☐ 1 ☐ 2 ☑ 3 ☑ 4

Project Approval – for use by ECpE Senior Design Committee

☑ Approved:  
sddc18-proj010

☐ Project Assigned:  

☐ Advisor(s) Assigned:  


Butterflies populations are often utilized as indicator species; from monitoring climate change to determining the quality of habitat restoration, butterfly numbers are used frequently to help answer scientific questions. However, across the nation and world, there is a lack of information on native butterfly species, their annual dispersal, and numbers. To fill this gap in information, the scientific community has begun relying on citizen scientists - volunteers of various backgrounds - to go out into the field and perform butterfly surveys.

In January 2013, Team Butterfly, Senior Design Team 13-08, set out to create the Unified Butterfly Recorder (UBR) app for the Android platform. Throughout 2013, with the collaboration of the Reiman Gardens Entomology staff, UBR was designed, programmed, and released in beta on the Google Play store to be tested by the community. This app has the potential to significantly and positively alter the course of global conservation research. It is being tested currently by researchers in the United States, Canada, Germany, the Netherlands, and other countries around the world. In July 2016, Senior Design Team 16-14 followed up with an iOS version of UBR that was developed using feedback from the community, these two versions allowed UBR to be used on a large share of mobile devices. The Reiman Gardens Entomology staff, along with utilizing UBR in their conservation work, frequently presents these apps and studies performed on their usability at various conferences in the entomology and conservation fields.

The release of the apps have produced a large amount of excitement throughout the community due to their ease of use, standardization of data, and the potential for visualization tools it can provide. However once this data is collected, the user must analyze the data manually.

The development of the UBR data recording applications is largely complete. However, to further these efforts we would like for the users to be able to analyze their data in an online web application with data visualization interfaces.

This phase of the project will include:
1. Creation of a server based application to interface with UBR apps and collect data from mobile client
2. Development of a user-specific web client to query data uploaded from UBR apps
3. Implementation of data analysis functionality for data obtained by a subset of registered surveyors
4. Implementation of an interface through which data can be sent to external conservation organizations.
5. Working directly with Reiman Gardens Entomology staff, butterfly conservation organizations, post graduates from previous projects

Non-critical elements of this phase include
1. An administrative level method for identifying and sorting observer data based on their survey method and experience level
2. Creativity in designing metrics that researchers may be interested in
3. Knowledge of iOS and/or Android development
Expected Deliverables:
Modification to the current Android and iOS UBR mobile app to work with Web based database so data can be shared with third party groups.

Specialized Resources Provided by Client:

Anticipated Cost: __________________________ Financial Resources Provided by Client: __________________________

Preferred Students for the Project:
☐ Electrical Engineering
☑ Computer Engineering
☐ Software Engineering
☐ Other:

Other Special Skills:

Anticipated Client Interaction (estimate):
☑ 1 meeting per week
☐ In person, ☐ Over the phone, ☐ Web / video conferencing

☐ 1 meeting per month
☐ In person, ☐ Over the phone, ☐ Web / video conferencing

☐ 2 or more meetings per month
☐ In person, ☐ Over the phone, ☐ Web / video conferencing

☐ 1 meeting per semester
☐ In person, ☐ Over the phone, ☐ Web / video conferencing

Meeting ABET Criteria

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☐ 0 □ 1 □ 2 □ 3 ☑ 4

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This project involves students from a variety of programs, i.e., CprE, EE, and SE
☐ 0 □ 1 □ 2 ☑ 3 □ 4

This project requires students to identify, formulate, and solve engineering problems
☐ 0 □ 1 □ 2 □ 3 ☑ 4

This project gives students an opportunity to use the techniques, skills,
Senior Design Project Proposal Form

and modern engineering tools necessary for engineering practice

Project Approval – for use by ECpE Senior Design Committee

☑ Approved:  sddec18-proj011

☐ Project Assigned:  

☐ Advisor(s) Assigned:  

________________________________________

________________________________________
Civil, Construction and Environmental Engineering (CCEE) and Electrical and Computer Engineering (ECpE) at Iowa State University

Submitter Name: Halil Ceylan, Professor of CCEE and Mani Mina, Associate Professor of ECpE
Email: hceylan@iastate.edu

Project Contact: Wei Shen Theh
Email: wstheh@iastate.edu

Project Title: Power distribution and controls for electrically conductive concrete (ECON) subsystem

Project Abstract:
ECON is a way of utilizing electricity to generate heat in specially-made conductive concrete. This exciting research is being implemented in several areas including in airports, roads, bridges, etc. The aim of this project is to create a Programmable Logic Controller (PLC) based power distribution system for ECON. This system will be controlled remotely via an online portal/platform.

Project goals:
1. Over the duration of two semesters, design and prepare an online portal/platform that includes PLC control, sensor data logging, and app/web development.
2. Semester 1 – Provide design approach with proof of concept prototype portal/platform connected to the PLC from a remote location.
3. Semester 2 – Provide finalized, working portal/platform that meets specifications as listed below.

Design Specifications:
1. Portal/platform allows user to connect to the PLC and control it (autonomous/manual) from remote location.
2. Portal/platform records sensor readings (temperature, moisture, voltage, etc.) and display live values.
3. Portal/platform routinely checks for unusual sensor activities and notifies user if necessary.

Expected Deliverables:
Semester 1: Design approach with proof of concept prototype.
Semester 2: Working, finalized portal/platform meeting the required specifications.

Specialized Resources Provided by Client:
PLC hardware and software, sensors, etc.

Anticipated Cost: Financial Resources Provided by Client:

Preferred Students for the Project:
☐ Electrical Engineering
☐ Computer Engineering
☐ Software Engineering
☐ Other:
Senior Design Project Proposal Form

Anticipated Client Interaction (estimate):

☑ 1 meeting per week
   ☑ In person, ☐ Over the phone, ☐ Web / video conferencing
☐ 1 meeting per month
   ☐ In person, ☐ Over the phone, ☐ Web / video conferencing
☐ 2 or more meetings per month
   ☐ In person, ☐ Over the phone, ☐ Web / video conferencing
☐ 1 meeting per semester
   ☐ In person, ☐ Over the phone, ☐ Web / video conferencing

Meeting ABET Criteria

Please rate the following statements as they relate to your proposed project:

0 – Not at all 1 – A Little 2 – Somewhat 3 – A Lot 4 – Completely

On this project, students will need to apply knowledge of mathematics, science, and engineering
☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

This project gives students an opportunity to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

This project involves students from a variety of programs, i.e., CprE, EE, and SE
☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

This project requires students to identify, formulate, and solve engineering problems
☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

This project gives students an opportunity to use the techniques, skills, and modern engineering tools necessary for engineering practice
☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

Project Approval – for use by ECpE Senior Design Committee

☑ Approved:  sddec18-proj012
☐ Project Assigned: 
☐ Advisor(s) Assigned:  
Civil, Construction and Environmental Engineering (CCEE) and Electrical and Computer Engineering (ECpE) at Iowa State University

Halil Ceylan, Professor of CCEE  hceylan@iastate.edu

Shuo Yang  shuoy@iastate.edu

Micro-Electro-Mechanical Systems (MEMS) based sensing system for soil conditions monitoring

Micro-Electromechanical Systems (MEMS) based sensing system has emerged as advanced/smart-sensing technologies with potential for cost-effective and long-term soil conditions monitoring. The aim of this project is to utilize the MEMS based temperature and moisture sensors for soil conditions monitoring to better understand soil freezing and thawing behaviors in Iowa. The sensors will be equipped with self-developed data acquisition system and then tested in the field to monitor soil temperature and moisture change under realistically environmental conditions.

1. Over the duration of two semesters, develop an Arduino (or other reliable technique) based data acquisition system for MEMS based temperature and moisture sensors and then test it in the field.
2. Semester 1 – Provide design approach with proof of concept prototype data acquisition system for the prepared MEMS temperature and moisture sensors
3. Semester 2 – Provide finalized data acquisition system that meets specifications as listed below and test it in the field

1. The self-developed data acquisition system can communicate with the prepared MEMS sensors for data recording
2. The self-developed data acquisition system has memory unit for data storage
3. The self-developed data acquisition system can record date and time for each group of data measured
4. The self-developed data acquisition system can check for unusual sensor activities and notifies user if necessary

Semester 1: Design approach with proof of concept prototype
Semester 2: Working, finalized data acquisition system meeting the required specifications

Self-made MEMS based temperature and moisture sensors

Electrical Engineering

Anticipated Cost: ___________________________________  Financial Resources Provided by Client: ________________________

Preferred Students for the Project:  ☑ Electrical Engineering  Other Special Skills:
Senior Design Project Proposal Form

☑ Computer Engineering  ☑ Software Engineering  ☐ Other:

**Anticipated Client Interaction (estimate):**
☐ 1 meeting per week
  ☐ In person, ☐ Over the phone, ☐ Web / video conferencing
☐ 1 meeting per month
  ☐ In person, ☐ Over the phone, ☐ Web / video conferencing
☑ 2 or more meetings per month
  ☑ In person, ☐ Over the phone, ☐ Web / video conferencing
☐ 1 meeting per semester
  ☐ In person, ☐ Over the phone, ☐ Web / video conferencing

**Meeting ABET Criteria**

Please rate the following statements as they relate to your proposed project:

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<th>0 – Not at all</th>
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<th>3 – A Lot</th>
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On this project, students will need to apply knowledge of mathematics, science, and engineering  ☑ 3

This project gives students an opportunity to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability  ☑ 4

This project involves students from a variety of programs, i.e., CprE, EE, and SE  ☑ 3

This project requires students to identify, formulate, and solve engineering problems  ☑ 4

This project gives students an opportunity to use the techniques, skills, and modern engineering tools necessary for engineering practice  ☑ 4

**Project Approval – for use by ECpE Senior Design Committee**

☑ Approved:  sddec18-proj013

☐ Project Assigned:  

☐ Advisor(s) Assigned:  


Client/Company/Organization:  Ames Laboratory

Submitter Name:  Grant Johnson  Email:  grantj@ameslab.gov

Project Title:
Using Open Source Intelligence to Visualize Industrial Controller Risk

Project Abstract:
Develop software tools that increase awareness of exposure to impending cyber attacks. This would be through a visual application that correlates publicly exposed critical cyber physical controller devices (ex ICS Shodan, Censys IO) with their publicly disclosed cyber security vulnerabilities (ex ICS-CERT, NVD). Perspective is to be from an organization (ex Utility operator) trying to monitor their exposed ICS devices and determine likelihood of impending cyber security compromise. This would be done by profiling as far as possible Device Purpose, Device Owner, Device Manufacturer, Device Version, etc and comparing to Device Vulnerabilities. User Interface would be a Web Application in Angular/Java Script (or equivalent) with Global Map visualization and database search APIs in Java/Python. Tools to include wire framing for UI design and exploration of contextual enrichment tools for an IP address (ex. geo location, whois, etc). Supplemental targeted scanning of publicly exposed devices is not desired for the project.

Expected Deliverables:
Software Deliverable - Web Site and micro services on internal server resources
Final Paper - Discuss methods and findings from correlation attempts as well as next steps
Documentation - Requirements/UI Wire Frame, Test Plans/Results, Configuration Index

Specialized Resources Provided by Client:
Accounts at Ames Laboratory and access to final deployment VM

Anticipated Cost:  Financial Resources Provided by Client:  

Preferred Students for the Project:
☐ Electrical Engineering  ☑ Computer Engineering
☑ Software Engineering  ☐ Other:

Anticipated Client Interaction (estimate):
☐ 1 meeting per week
   ☐ In person, ☐ Over the phone, ☐ Web / video conferencing
☐ 1 meeting per month
   ☐ In person, ☐ Over the phone, ☐ Web / video conferencing
☑ 2 or more meetings per month
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1 meeting per semester
   ☐ In person, ☐ Over the phone, ☐ Web / video conferencing

### Meeting ABET Criteria

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### Project Approval – for use by ECpE Senior Design Committee

☑ Approved:                      sddec18-proj014

☐ Project Assigned:

☐ Advisor(s) Assigned:

________________________________________

________________________________________
Client/Company/Organization: Iowa State University

Submitter Name: Robert Bouda
Email: nybouda@iastate.edu

Project Contact: Lotfi ben Othmane
Email: othmanel@iastate.edu

Project Title: Digital Twin for Low cost Applications

Project Abstract:
Digital twin is a methodology for integrating the physical and virtual worlds of the product, including its engineering design and operational functions. The combination of both attributes enables design improvements and continuous process improvements. This technique is currently only used by few professionals--product engineers and data scientists--in the industries, such as manufacturing and utilities. In the next decade, The application domain of the methodology will increase significantly. The goal of the project is to design a system to gather information for a digital twin. The system will help doing research in the domain. The system that we want to develop should consist of the following 2 parts:

Part 1 Software: Two (2) applications for collection of sensors data (e.g.: Vibration, Audio, Illumination, Color, Motion etc), one (1) for mobile applications. The sensors will have the following capabilities:
• Inbound and outbound information to a server via WiFi,
• A server for data storage and mining--suports machine learning /AI capabilities.

Part 2 Hardware
• A PCB board with all functional sensors powered with USB 2.0 or 3.0 connector
• Functional system with examples that demonstrate it.

Expected Deliverables:
- Expected Deliverables First semester
  • Demonstrable working prototype of the system
  • PCB layout of the circuit
- Expected Deliverables Second semester
  • Fully developed and implemented software applications
  • Designed circuit board with integrated sensors

Specialized Resources Provided by Client:
TBD

Anticipated Cost: __________________________  Financial Resources Provided by Client: __________________________

Preferred Students for the Project:
☑ Electrical Engineering  
☑ Computer Engineering  
Other Special Skills: PCB Layout, Circuit design, Python, SQL
Anticipated Client Interaction (estimate):

☐ 1 meeting per week
   ☑ In person, ☐ Over the phone, ☐ Web / video conferencing
☐ 1 meeting per month
   ☐ In person, ☐ Over the phone, ☐ Web / video conferencing
☐ 2 or more meetings per month
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☐ 1 meeting per semester
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Meeting ABET Criteria

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Project Approval – for use by ECpE Senior Design Committee

☑ Approved:  sddec18-proj015
☐ Project Assigned:  
☐ Advisor(s) Assigned:  
Senior Design Project Proposal Form

Client/Company/Organization: Argonne National Laboratory

Submitter Name: Benjamin Blakely Email: bblakely@anl.gov

Project Contact: Email:

Project Title: Software-Defined Network Moving Target Defense

Project Abstract:
Moving Target Defense is the concept of introducing diversity, ambiguity, or responsiveness into an information system to make an attacker’s job harder. Some implementations are very low level - for example Address Space Layout Randomization that is part of all modern operating systems. Others may rotate requests through different operating systems, daemons, or applications. One concept is that of using software-defined networks (virtualized network components that can be changed “on the fly”) to obfuscate or complicate the network underlying a service. By doing so it may be harder for an attacker to identify which system is hosting the target service, or make it difficult to maintain a consistent connection to any given system. Because SDN allows us to make rules for any address/port combo, we can make separate addresses for different services running on each server and use the networking to route each of these outward-facing addresses back to an actual machine. In addition to being able to remap any address/port combo to a server in whatever way we want, we can also add honeypot services with known vulnerabilities to reveal malicious attackers. Average users of a system would never have any need to contact these honeypot services meaning that if they are contacted, or exploited, we know it must be by an attacker or someone who is overly-curious at minimum. Finally, we can map fake dummy ports and services to a service running on the SDN to simply respond with a basic fingerprint of a non-existent service. We can then, again, use these as honeypot services because the only people that would know of their existence would be people who scanned the network. A prototype system can be built using freely available tools such as Mininet or OpenStack.

Expected Deliverables:
* A Prototype system implementing at least host/path obfuscation, and ideally also implementing honeypot hosts/paths.
* An evaluation of the effectiveness of the system in reducing the ability of an attacker to identify and attack hosts
* An evaluation of the performance impact of the system as compared to a normal, non-MTD host

Specialized Resources Provided by Client:
Hardware may be attainable, if needed. However the intent is to first try to use tools that can be deployed to your local systems.

Anticipated Cost: Financial Resources Provided by Client:

Preferred Students for the Project:
☐ Electrical Engineering
☑ Computer Engineering
☑ Software Engineering
☐ Other:

Other Special Skills: Information Security, Networking, System Administration
Senior Design Project Proposal Form

Anticipated Client Interaction (estimate):

☐ 1 meeting per week
   ☐ In person, ☐ Over the phone, ☐ Web / video conferencing
☐ 1 meeting per month
   ☐ In person, ☐ Over the phone, ☐ Web / video conferencing
☑ 2 or more meetings per month
   ☐ In person, ☐ Over the phone, ☐ Web / video conferencing
☐ 1 meeting per semester
   ☐ In person, ☐ Over the phone, ☐ Web / video conferencing

Meeting ABET Criteria

Please rate the following statements as they relate to your proposed project:

| On this project, students will need to apply knowledge of mathematics, science, and engineering |
|---------------------------------|-----|-----|-----|-----|
| 0 – Not at all                  | 1 – A Little | 2 – Somewhat | 3 – A Lot | 4 – Completely |
| ☐ 0                                | ☐ 1 | ☐ 2 | ☐ 3 | ☑ 4 |

This project gives students an opportunity to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

☐ 0                                ☐ 1 | ☐ 2 | ☐ 3 | ☑ 4

This project involves students from a variety of programs, i.e., CprE, EE, and SE

☐ 0                                ☐ 1 | ☐ 2 | ☐ 3 | ☑ 4

This project requires students to identify, formulate, and solve engineering problems

☐ 0                                ☐ 1 | ☐ 2 | ☐ 3 | ☑ 4

This project gives students an opportunity to use the techniques, skills, and modern engineering tools necessary for engineering practice

☐ 0                                ☐ 1 | ☐ 2 | ☐ 3 | ☑ 4

Project Approval – for use by ECpE Senior Design Committee

☑ Approved: sddec18-proj016

☐ Project Assigned: ________________________________

☐ Advisor(s) Assigned: ________________________________
Client/Company/Organization: Iowa State University

Submitter Name: Mani Mina Email: mmina@iastate.edu

Project Contact: Jayaprakash Selvaraj Email: jprakash@iastate.edu

Project Title: High Speed Magnetic Field Generator

Project Abstract:
This project requires a fundamental understanding of circuit design, test and measurement. It will be advantageous if students are familiar with circuit simulation and layout tools (e.g. PSpice, OrCAD, Eagle PCB, etc.).

Main Goals:
1. Over the duration of two semesters, design and fabricate an electronic/magnetic circuit that can generate a magnetic flux density of about 500 Gauss for a particular pulse width.
2. Semester 1 - Provide design approach with proof of concept prototype that can achieve an electronic switching time between 100-150ns and magnetic flux density of about 500 Gauss
3. Semester 2 - Provide a working final device, professionally fabricated meeting the required specifications

Design Specifications:
1. Flux density: Greater than or equal to 500 Gauss
2. Switching Time: 50 - 100 ns
3. Programmable control of magnetic pulse generation

Expected Deliverables:
  Semester 1: Design approach with proof of concept prototype
  Semester 2: Working device with adequate software control

Specialized Resources Provided by Client:
Access to test and measurement equipment in Magnetics/ High Speed Systems lab

Anticipated Cost: Financial Resources Provided by Client: 1000

Preferred Students for the Project:
☑ Electrical Engineering
☑ Computer Engineering
☐ Software Engineering
☐ Other: Understanding of high-speed systems is preferred but not mandatory.

Anticipated Client Interaction (estimate):
☑ 1 meeting per week
☑ In person, ☐ Over the phone, ☐ Web / video conferencing
1 meeting per month
☐ In person, ☐ Over the phone, ☐ Web / video conferencing
2 or more meetings per month
☐ In person, ☐ Over the phone, ☐ Web / video conferencing
1 meeting per semester
☐ In person, ☐ Over the phone, ☐ Web / video conferencing

Meeting ABET Criteria

Please rate the following statements as they relate to your proposed project:

0 – Not at all  1 – A Little  2 – Somewhat  3 – A Lot  4 – Completely

On this project, students will need to apply knowledge of mathematics, science, and engineering
☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

This project gives students an opportunity to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

This project involves students from a variety of programs, i.e., CprE, EE, and SE
☐ 0  ☐ 1  ☐ 2  ☑ 3  ☐ 4

This project requires students to identify, formulate, and solve engineering problems
☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

This project gives students an opportunity to use the techniques, skills, and modern engineering tools necessary for engineering practice
☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

Project Approval – for use by ECpE Senior Design Committee

☑ Approved: sddec18-proj017
☐ Project Assigned:
☐ Advisor(s) Assigned:
Client/Company/Organization: EE432/532

Submitter Name: Meng Lu Email: menglu@iastate.edu

Project Title:
Developing an augmented reality technology for the IC fabrication laboratory

Project Abstract:
This project will develop an augmented reality (AR) tool to provide EE432/532 students interactive experience and information they need to understand state-of-the-art IC fabrication process and laboratory instruments. Semiconductor process equipment plays a vital role in IC production and requires extensive maintenances, so it is critical that users of Microelectronic Research Center (including EE432/532 students) know the operation procedure precisely and report problems timely.

The proposed AR tool consists of a mobile APP and quadcodes on each tool (spinner, mask aligner, wet bench, furnace, evaporator, probe station, etc.). Before operating a tool, users will use the camera on their devices (a cell phone or tablet) to scan the quadcode. The APP then provide related information (log sheet, instruction video, manufacture manual, MSDS, course material). Students can also chat with TA, MRC technician, or course instructors for the problem they meet during the process. In addition to providing the interactive learning experience, the AR technology will help us protect our delicate and expensive lab instrument.

Expected Deliverables:
The expected deliverables are listed below:
1. A mobile APP (Andriod and iOS) that serves as a GUI
2. A cloud database that stores related materials (videos, pdf files, spreadsheet)
3. Testing the AR with Spring 2018 EE432/532 students
4. A survey of user experience from students

Specialized Resources Provided by Client:
SDK and IDE

Anticipated Cost: Financial Resources Provided by Client: 

Preferred Students for the Project:
- Electrical Engineering
- Software Engineering
- Other Special Skills: Mobile app development
- Other: Preferably, one EE student who is taking (or has taken) EE432 and two SE students

Anticipated Client Interaction (estimate):
Senior Design Project Proposal Form

☑ 1 meeting per week
   ✓ In person, ☐ Over the phone, ☐ Web / video conferencing
☐ 1 meeting per month
   ☐ In person, ☐ Over the phone, ☐ Web / video conferencing
☐ 2 or more meetings per month
   ☐ In person, ☐ Over the phone, ☐ Web / video conferencing
☐ 1 meeting per semester
   ☐ In person, ☐ Over the phone, ☐ Web / video conferencing

Meeting ABET Criteria

Please rate the following statements as they relate to your proposed project:

<table>
<thead>
<tr>
<th>0 – Not at all</th>
<th>1 – A Little</th>
<th>2 – Somewhat</th>
<th>3 – A Lot</th>
<th>4 – Completely</th>
</tr>
</thead>
</table>

On this project, students will need to apply knowledge of mathematics, science, and engineering
☐ 0 ☐ 1 ☐ 2 ☐ 3 ✓ 4

This project gives students an opportunity to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
☐ 0 ☐ 1 ☐ 2 ☐ 3 ✓ 4

This project involves students from a variety of programs, i.e., CprE, EE, and SE
☐ 0 ☐ 1 ☐ 2 ☐ 3 ✓ 4

This project requires students to identify, formulate, and solve engineering problems
☐ 0 ☐ 1 ☐ 2 ✓ 3 ☐ 4

This project gives students an opportunity to use the techniques, skills, and modern engineering tools necessary for engineering practice
☐ 0 ☐ 1 ☐ 2 ✓ 3 ☐ 4

Project Approval – for use by ECpE Senior Design Committee

☑ Approved: sddec18-proj018
☐ Project Assigned: 
☐ Advisor(s) Assigned: 
Typical garbage/waste management in urban areas is handled on a ""periodic basis"" -- i.e., with trucks visiting individual streets/blocks at (almost) fixed and predetermined times. These types of approaches typically assume some ""steady-state"" of consumption of different goods and, thereby, generation of garbage/leftovers. However, there may be periods where the spatio-temporal distribution of generating garbage-like materials can exhibit variability, e.g., (1) in preparation for major holidays (not only after such holidays), there may be a spatially-uniform distribution; (2) prior (as well as after) larger-scale social events, there may be spatial zones that are different in terms of their ""garbage load"". (3) Materials that can have toxic impact may require not only fast response, but even pre-planning (regardless of the spatial distribution).

The main objective of this project is to provide a full-fledged system for smart(er) management of gathering garbage/waste/toxic materials. The initial idea is to have solution at all the levels of granularity: (1) Individual garbage can/container -- example: one may need both weight/pressure sensor, as well as infra-red type of sensor (i.e., to detect that certain height has been exceeded); (2) Have a data-aggregation from multiple sensors, and provide a ""topographical map"" of the distribution in a given/reference system; (3) have a dedicated serve that can plan the routes for the garbage trucks in such ""irregular scenarios"" (based on particular constraints); (4) incorporate ML techniques to enable predictive capabilities so that a longer-term plans can be made (e.g., vacation for employees).

The desired range of deliverable-items throughout 491 is envisioned as:
1. Identify the scope of each part of the project, along with feasibility -- (Week 3);
2. Identify possible testing/verification scenarios -- (Week 5);
3. Identify references in terms of research literature and other technical documents to be read by the students -- (Week 6)
4. Present a first draft of the design for the envisioned: (a) overall system architecture; (b) each of the well-identified major components -- (Week 8);
ADDENDUM: Identify individuals in the City of Ames council that could serve as additional guide...
5. Provide a draft for the financial analysis of the purchases/resources needed for the identified test-cases/scenarios - (Week 10);
6. Present a first draft of the overall design document, paying attention to the justification(s) needed for aspects above (related works; feasibility; finances); first draft of the poster; and (if possible) demo-related descriptions -- Week 12;
7. Revised version of the design document and the poster, along with the presentation slides -- week 14.
Senior Design Project Proposal Form

Anticipated Cost: __________________________ Financial Resources Provided by Client: __________________________

Preferred Students for the Project:

- ☑ Electrical Engineering
- ☑ Computer Engineering
- ☑ Software Engineering
- ☐ Other: __________________________

Other Special Skills:

- ☑ Computer Engineering
- ☑ Software Engineering

Anticipated Client Interaction (estimate):

- ☐ 1 meeting per week
  - ☐ In person, ☐ Over the phone, ☐ Web / video conferencing
- ☐ 1 meeting per month
  - ☐ In person, ☐ Over the phone, ☐ Web / video conferencing
- ☑ 2 or more meetings per month
  - ☑ In person, ☐ Over the phone, ☐ Web / video conferencing
  - ☐ 1 meeting per semester
    - ☐ In person, ☐ Over the phone, ☐ Web / video conferencing

Meeting ABET Criteria

Please rate the following statements as they relate to your proposed project:

| On this project, students will need to apply knowledge of mathematics, science, and engineering |
| 0 – Not at all | 1 – A Little | 2 – Somewhat | 3 – A Lot | 4 – Completely |
| ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☑ 4 |

| This project gives students an opportunity to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability |
| 0 – Not at all | 1 – A Little | 2 – Somewhat | 3 – A Lot | 4 – Completely |
| ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☑ 4 |

| This project involves students from a variety of programs, i.e., CprE, EE, and SE |
| 0 – Not at all | 1 – A Little | 2 – Somewhat | 3 – A Lot | 4 – Completely |
| ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☑ 4 |

| This project requires students to identify, formulate, and solve engineering problems |
| 0 – Not at all | 1 – A Little | 2 – Somewhat | 3 – A Lot | 4 – Completely |
| ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☑ 4 |

| This project gives students an opportunity to use the techniques, skills, and modern engineering tools necessary for engineering practice |
| 0 – Not at all | 1 – A Little | 2 – Somewhat | 3 – A Lot | 4 – Completely |
| ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☑ 4 |

Project Approval – for use by ECpE Senior Design Committee

- ☑ Approved: sddec18-proj019
- ☐ Project Assigned: __________________________
Senior Design Project Proposal Form

Client/Company/Organization: 

Submitter Name: Kelli Rout
Email: ms.kelli15@gmail.com

Project Contact: 
Email: 

Project Title: Hidden Guardian

Project Abstract:
This project consists of 3 parts.

First would entail building a Speaker that has Bluetooth and Wi-fi capabilities. It is designed to connect to Xbox and PS consoles. It will have a built in microphone, chat volume button, game volume, sync, power, and mute button. The power supply to the speaker would be rechargeable through the game system and have a power cord for portability. It would be used as a safety devise to listen to live conversations or used in replace of a headset. Each speaker would come with it own 1 time use code for the software download.

Second would be software that is downloadable onto an Xbox and PS gaming systems. The software would recognize when the game system is powered on. It would record and store all text messages, voice conversations, and friends list. It would have the function to recognize key words, such as, phone number, address and meet and then notify a pre designated number and/or email. The software would only be able to be disabled or deleted with a parental passcode.

Third is an App that would allow access to log on to a PC, tablet or smartphone and listen to live or previously recorded conversations, read messages and monitor friends list. The App is where you would enter what key words or phrases you would like the software to recognize. The only way to permanently delete recorded activity is though the App.

This is a safety device to monitor children's online activities and conversations. It has the potential to curb online bullying and notify parents or others of any potentially dangerous situation. It also could be used in replace of a headset without downloading the software.

Expected Deliverables:
I would like an early proof-of-concept the beginning of summer

Specialized Resources Provided by Client:

Anticipated Cost: 
Financial Resources Provided by Client: 

Preferred Students for the Project:
☑ Electrical Engineering
☑ Computer Engineering
☑ Software Engineering

Other Special Skills:
Senior Design Project Proposal Form

☐ Other:

**Anticipated Client Interaction (estimate):**

- ☑ 1 meeting per week
  - ☑ In person, ☑ Over the phone, ☑ Web / video conferencing
- ☐ 1 meeting per month
  - ☐ In person, ☐ Over the phone, ☐ Web / video conferencing
- ☐ 2 or more meetings per month
  - ☐ In person, ☐ Over the phone, ☐ Web / video conferencing
- ☐ 1 meeting per semester
  - ☐ In person, ☐ Over the phone, ☐ Web / video conferencing

**Meeting ABET Criteria**

Please rate the following statements as they relate to your proposed project:

<table>
<thead>
<tr>
<th>0 – Not at all</th>
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<th>3 – A Lot</th>
<th>4 – Completely</th>
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</table>

On this project, students will need to apply knowledge of mathematics, science, and engineering

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☑ 4

This project gives students an opportunity to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☑ 4

This project involves students from a variety of programs, i.e., CprE, EE, and SE

☐ 0 ☐ 1 ☐ 2 ☑ 3 ☐ 4

This project requires students to identify, formulate, and solve engineering problems

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☑ 4

This project gives students an opportunity to use the techniques, skills, and modern engineering tools necessary for engineering practice

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☑ 4

**Project Approval – for use by ECpE Senior Design Committee**

- ☑ Approved: sddec18-proj020
- ☐ Project Assigned: 
- ☐ Advisor(s) Assigned:
Senior Design Project Proposal Form

Client/Company/Organization: Tom Daniels

Submitter Name: Tom Daniels Email: daniels@iastate.edu

Project Contact: Email:

Project Title: Holiday Reverse Programmable Light Strings

Project Abstract:

The goal is to create a system to make arbitrary 2-D patterns using strings of RGB LEDs wrapped around a pagan arborial holiday display. The user will decorate the tree with lights in an arbitrary, yet generally equally spaced manner. The LEDs will then illuminate in such a way that a smart phone can use its camera in video mode to 3-D locate each LED. The system will then be able to create and display animated color patterns from 1 or more viewing perspectives.

Expected Deliverables:

The students will deliver a controller module that can drive enough lights to illuminate a typical home tree as well as the smartphone software needed to scan the display and create the pattern.

Specialized Resources Provided by Client:

Anticipated Cost: Financial Resources Provided by Client:

Preferred Students for the Project:

☑ Electrical Engineering
☑ Computer Engineering
☐ Software Engineering
☐ Other: Other Special Skills: one or more students comfortable with computer vision, comfort with ios

Anticipated Client Interaction (estimate):

☑ 1 meeting per week
   ☑ In person, ☐ Over the phone, ☐ Web / video conferencing
☐ 1 meeting per month
   ☐ In person, ☐ Over the phone, ☐ Web / video conferencing
☐ 2 or more meetings per month
   ☐ In person, ☐ Over the phone, ☐ Web / video conferencing
☐ 1 meeting per semester
   ☐ In person, ☐ Over the phone, ☐ Web / video conferencing

Meeting ABET Criteria
Please rate the following statements as they relate to your proposed project:

<table>
<thead>
<tr>
<th>Statement</th>
<th>0 – Not at all</th>
<th>1 – A Little</th>
<th>2 – Somewhat</th>
<th>3 – A Lot</th>
<th>4 – Completely</th>
</tr>
</thead>
<tbody>
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<td>On this project, students will need to apply knowledge of mathematics, science, and engineering</td>
<td>☐ 0</td>
<td>☐ 1</td>
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<td>☐ 1</td>
<td>☐ 2</td>
<td>☐ 3</td>
<td>☑ 4</td>
</tr>
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<td>This project involves students from a variety of programs, i.e., CprE, EE, and SE</td>
<td>☐ 0</td>
<td>☐ 1</td>
<td>☐ 2</td>
<td>☑ 3</td>
<td>☐ 4</td>
</tr>
<tr>
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<td>☐ 0</td>
<td>☐ 1</td>
<td>☐ 2</td>
<td>☐ 3</td>
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<td>☐ 1</td>
<td>☐ 2</td>
<td>☐ 3</td>
<td>☑ 4</td>
</tr>
</tbody>
</table>

Project Approval – for use by ECpE Senior Design Committee

☑ Approved: sddec18-proj021
☐ Project Assigned: __________________________________________
☐ Advisor(s) Assigned: _________________________________________
Project Title:
High-Level Design of Distribution Microgrid

Project Abstract:
Alliant Energy has several island distribution systems that are isolated from the rest of the system. With changing technology building a microgrid has become achievable from both a technological and economic standpoint. The group will be given a yearly maximum kw peak, yearly maximum kwh, and a coordinate location and need to design a solar plus battery solution for the system.

Microgrids are a self-contained organization of distribution energy resources (DERs) capable of islanding. The first DC microgrid built by Edison in 1882 and was diminished due to the industry transforming to AC. Fast forward to the present, new technologies and development have created a market for the microgrid once more. The goals of the project will be:

1. Develop a detailed plan to meet the loading demands in all adverse conditions and future growth of the area.
2. Assess and optimize the costs of the developed plan.
3. Analyze and compare the loading demands for summer and winter worst case scenarios such as cloudy days, winter solstice, etc.

OpenDSS and MATLAB softwares will be used for the simulation and analysis. Basic understanding of electric power systems (EE303) will be required for the project.

Expected Deliverables:
1. Develop a detailed plan to meet the loading demands in all adverse conditions and future growth of the area.
2. Assess and optimize the costs of the developed plan.
3. Analyze and compare the loading demands for summer and winter worst case scenarios such as cloudy days, winter solstice, etc.

Specialized Resources Provided by Client:
No specialized resources will be needed for this project.

Anticipated Cost: ________________  Financial Resources Provided by Client: ________________

Preferred Students for the Project:
☑ Electrical Engineering
☑ Computer Engineering
☐ Software Engineering
☐ Other:
Anticipated Client Interaction (estimate):

- ☑ 1 meeting per week
  - ☐ In person, ☐ Over the phone, ☑ Web / video conferencing
- ☑ 1 meeting per month
  - ☐ In person, ☐ Over the phone, ☑ Web / video conferencing
- ☐ 2 or more meetings per month
  - ☐ In person, ☐ Over the phone, ☑ Web / video conferencing
- ☑ 1 meeting per semester
  - ☐ In person, ☐ Over the phone, ☑ Web / video conferencing

Meeting ABET Criteria

Please rate the following statements as they relate to your proposed project:

- 0 – Not at all
- 1 – A Little
- 2 – Somewhat
- 3 – A Lot
- 4 – Completely

On this project, students will need to apply knowledge of mathematics, science, and engineering

☐ 4

This project gives students an opportunity to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

☐ 4

This project involves students from a variety of programs, i.e., CprE, EE, and SE

☐ 4

This project requires students to identify, formulate, and solve engineering problems

☐ 4

This project gives students an opportunity to use the techniques, skills, and modern engineering tools necessary for engineering practice

☐ 4

Project Approval – for use by ECpE Senior Design Committee

- ☑ Approved: sddec18-proj022
- ☐ Project Assigned:
- ☐ Advisor(s) Assigned:
Client/Company/Organization: True 360

Submitter Name: Chris James Email: chris906@iastate.edu

Project Contact: Chris James Email: chris906@iastate.edu

Project Title: 360 Web Cams for Zoo's and Aquariums

Project Abstract:
True 360 is a start up founded by students at Iowa State University. We have been collaborating with various zoos and aquariums across the country to create a more immersive webcam experience using 360 cameras and virtual reality headsets. We would now like to open a new product line (mostly software, but cameras, computers and other hardware will be needed) that allows easy live event planning for the zoos and monitors the animal’s health. The live events will get more kids interested in conservation and animal ecology by providing classrooms with free and easy access to teaching events at the zoo, and the animal health monitors will save the zookeepers the headache of having to constantly monitor sick animals. These cameras will be 360, but bandwidth is often an issue for zoo’s so compressing the footage may be necessary. Software will have to be made to run the web-cams. We use Insta360 pros and Ricoh thetas, which are both capable of live streaming, but aren’t web-cams in and of themselves. The team will need to create a web app that can remotely control and monitor the cameras (Turn off and on, monitor power, and temperature, zoom in and pan, etc) and also create a robust case and computer system that works under low bandwidth and is weather proof and animal proof. You also will be creating a web app that allows the marketing team of zoos to easily run promotional events through the web-cams to various platforms like Facebook and YouTube. Lastly a computer app will need to be created that uses a database, and algorithms to monitor animal health and look for signs of abnormal behavior. Since we are a startup we will be running on a limited budget, but we are looking to provide internships over the summer and possibly bring on more teammates to the founding team. You will be given ambitious goals, pushed hard, but allowed the freedom to work on them at your own pace.

Expected Deliverables:

- 360 web-cam that can be controlled remotely and is weatherproof/waterproof/animal proof.
- Live event software that allows the zoo’s marketing teams to easily plan, promote and host live events and the Zookeepers to easily teach live events with the click of a button.
- Animal Health monitoring software that uses algorithms and databases to look for abnormal behaviors.

Specialized Resources Provided by Client:

- Insta360 Pro camera
- Ricoh Theta
- Raspberry Pi’s and sensors along with a budget to buy more parts if needed.
- Google daydreams
- Ethernet, usb, hdmi, and power cables
- Office Space (Duel Monitor and in a collaborative setting)
- Workspace and access to Boyd Labs
- Engineering Consultants (We want to push the team out of your comfort zones and can find consultants when you reach roadblocks or want to learn more about a subject.)
Senior Design Project Proposal Form

Anticipated Cost: _____________________________

Financial Resources Provided by Client: 20000

Preferred Students for the Project:

☐ Electrical Engineering
☑ Computer Engineering
☑ Software Engineering

Other Special Skills: - Software Engineers
  o Web App
  o PHP
  o Ajax
  o HTML
  o CSS
  o JavaScript
  o Node.js (server side)
  o Angular
  o Database
  o MySQL
  o Java (computer app)
  - Understanding of 360 camera hardware.
  - Understanding of hardware required to stream high quality video.
  - Very basic understanding of materials, manufacturing, and engineering of cases.

☐ Other:

Anticipated Client Interaction (estimate):

☑ 1 meeting per week
  ☑ In person, ☐ Over the phone, ☐ Web / video conferencing

☐ 1 meeting per month
  ☐ In person, ☐ Over the phone, ☐ Web / video conferencing

☐ 2 or more meetings per month
  ☐ In person, ☐ Over the phone, ☐ Web / video conferencing

☐ 1 meeting per semester
  ☐ In person, ☐ Over the phone, ☐ Web / video conferencing

Meeting ABET Criteria

Please rate the following statements as they relate to your proposed project:

0 – Not at all  1 – A Little  2 – Somewhat  3 – A Lot  4 – Completely

On this project, students will need to apply knowledge of mathematics, science, and engineering ☐ 0  ☐ 1  ☐ 2  ☑ 3  ☐ 4

This project gives students an opportunity to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability ☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

This project involves students from a variety of programs, i.e., CprE, EE, ☐ 0  ☐ 1  ☑ 2  ☐ 3  ☐ 4
and SE

This project requires students to identify, formulate, and solve engineering problems ☐ 0 ☐ 1 ☐ 2 ☐ 3 ☑ 4

This project gives students an opportunity to use the techniques, skills, and modern engineering tools necessary for engineering practice ☐ 0 ☐ 1 ☐ 2 ☐ 3 ☑ 4

Project Approval – for use by ECpE Senior Design Committee

☑ Approved: sddec18-proj023

☐ Project Assigned: 

☐ Advisor(s) Assigned: 

________________________________________

________________________________________
Client/Company/Organization: MNPHARM

Submitter Name: Dave Roeser Email: droeser@mnpharm.com

Project Contact: Dave Roeser Email: droeser@mnpharm.com

Project Title: App for Laboratory Collaboration and Process Control

Project Abstract:
MNPHARM is a Public Benefit Corporation in Oakdale, MN working to reduce the cost of new therapeutics for human and animal health through molecular farming. The project would involve writing an app that would be unique to MNPHARM for documentation recording in accordance with GLP and GMP standards. This project might involve other life science students for input for the structure and content of the application. Scientific notes are taken and recorded for collaboration between employees working different days or hours. Company needs to reach Good Mfg and Lab Practices (GMP & GLP) to sell products. Without collaboration, experiments are slower and errors happen.

Here is an outline of the scope of work for the project:

- Secure cloud based
- Include area for “Lab Notes” from scientists and other researchers
- Library of Standard Operation Procedures (SOP)
- Interactive document of SOP’s with check off for each step and final signature once complete
- Integrate existing Excel Chemical Storage Log and link to inventory value and reordering
- Equipment maintenance schedules and similar check off feature as SOP’s
- Secure storage for other process results from lab processing equipment
- Production schedule app based on MNPHARM’s process
- Scheduling app for employees to coordinate their work schedules
- Companywide calendar for interaction and notice of employees schedules

Expected Deliverables:

- We have SOP’s, and need a standard format that can be check list also. Easy adding future SOP’s. Linking in real time chemical inventory for use, safety and re-order. Follow GMP & GLP guidelines for data that needs recording (bullet points in above section). Searchable for FDA audit standards.

Expected Deliverables:
1. Workable app for laptop or smart phone
2. Secure storage of data for internal use only
3. Collaboration between computer science (application, network, storage) and interviews with lab workers at ISU and MNPHARM
4. SOP’s that can also be used for manufacturing check list documentation
5. Proprietary to MNPHARM to help safe guard trade secret SOP’s
6. Searchable lab notes
Specialized Resources Provided by Client:
Access to MNPHARM CEO and lab staff. ZOOM conference calls with student group to help mentor students on business issues and deliverables.

Anticipated Cost: Low cost. Should be student time writing app. Travel on campus to interview lab workers. Occasion Skype or ZOOM calls with MNPHARM to project meetings, interview users and testing.

Financial Resources Provided by Client:

Preferred Students for the Project:
☐ Electrical Engineering
☐ Computer Engineering
☑ Software Engineering
☐ Other: App and database

Other Special Skills: We believe an app format will be beneficial to the students as more business processes are going in this direction. This will also be an easy to use app for technical and general lab techs, so communication and listening skills to solve the problem will be as needed as technical skills.

Anticipated Client Interaction (estimate):
☐ 1 meeting per week
☐ 1 meeting per month
☑ 2 or more meetings per month
☐ 1 meeting per semester

Meeting ABET Criteria
Please rate the following statements as they relate to your proposed project:

0 – Not at all  1 – A Little  2 – Somewhat  3 – A Lot  4 – Completely

On this project, students will need to apply knowledge of mathematics, science, and engineering
☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

This project gives students an opportunity to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and
☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4
This project involves students from a variety of programs, i.e., CprE, EE, and SE

☐ 0  ☐ 1  ☑ 2  ☐ 3  ☐ 4

This project requires students to identify, formulate, and solve engineering problems

☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

This project gives students an opportunity to use the techniques, skills, and modern engineering tools necessary for engineering practice

☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

Project Approval – for use by ECpE Senior Design Committee

☑ Approved: sddec18-proj025

☐ Project Assigned:

☐ Advisor(s) Assigned:

__________________________________________________________
Project Title:

Asset management - Financial Factor Discovery - "Value"

Project Abstract:

This project will allow you to exercise all your engineering skills and interests in a financial Big Data, Data Analytics, and Data Sciences project.

In financial markets, an investor must accept additional risk to achieve additional expected returns. This type of risk is often categorized into what are called risk premia or risk factors. For example, investing in smaller companies has historically led to higher returns than larger companies, but at the cost of additional variance of the returns. This risk factor is known as VALUE.

Investment strategies based on these risk factors are known as Factor-Based Investing. These strategies are becoming increasingly popular and form the backbone of Principal Global Equities’ investment process.

To improve our factor-based process, you will research two areas:

- Factor performance forecasting: How will each risk factor perform in the next time period?
- Factor-based portfolio optimization: What overall risk factor exposures will lead to the highest risk-adjusted returns?

The project work is comprised of three main parts. First, you will study and measure the current forecasting process and define a model validation procedure. Next, you will research and test new modeling methods. Finally, you will use the predictions from your models to create optimal factor-based portfolios. Each of these steps is discussed in more detail below.

Expected Deliverables:

Part 1: Current State Analysis

1. Review and document all aspects of the current forecasting process including: inputs, model, parameter tuning, and performance. This will serve as a baseline for comparing new methods.

2. Create a standard process to estimate out-of-sample error. Choose split and error metric.

Part 2: Algorithm Exploration

1. Define list of algorithms to explore and associated tuning parameters to consider

2. Research and test algorithms using standard process and metrics from Part 1

3. Test model combination methods like bagging, boosting, and stacking
4. Analyze and compare response types including both categorical and continuous representations

Desired Final Results

Part 1: Current State Analysis

1. Process map and documentation of current forecasting process
2. Documentation and reasoning for proposed validation procedure
3. Performance report of current model using proposed validation procedure

Part 2: Algorithm Exploration

1. Documentation and quantitative results of all explored modeling methods.
2. Quantitative comparison of response types (categorical vs. continuous)
3. Comparison “matrix” of all methods using the following criteria:
   - Predictive accuracy
   - Interpretability
   - Computational complexity
   - Other criteria proposed by team
4. Final recommendations and barriers to implementing recommended methodology
5. Model prototype of recommended algorithm written in R or python

Business Impact

1. Good understanding of current process and areas of improvement for Principal stakeholders and project team
2. Clearly defined framework for comparing new modeling methods to current process leading to more efficient and impactful research
3. Improved forecast accuracy leading to better risk premia and asset selection
4. Increased portfolio returns, reduced risk
5. Establish PGI as a leader in quantitative, data-driven financial products
6. Potentially higher risk-adjusted returns
7. Foundational research that can be extended to multi-asset class portfolios

Specialized Resources Provided by Client:
Senior Design Project Proposal Form

PGI will provide all relevant subject matter expertise necessary to enable project success

Anticipated Cost: __________________________ Financial Resources Provided by Client: project success

Preferred Students for the Project:
- ☑ Electrical Engineering
- ☑ Computer Engineering
- ☑ Software Engineering
- ☐ Other:

Other Special Skills: Strong big data, data analytics, quantitative, and mathematical acumen desired

Anticipated Client Interaction (estimate):
- ☑ 1 meeting per week
  - ☐ In person, ☑ Over the phone, ☐ Web / video conferencing
- ☐ 1 meeting per month
  - ☐ In person, ☐ Over the phone, ☐ Web / video conferencing
- ☐ 2 or more meetings per month
  - ☐ In person, ☐ Over the phone, ☐ Web / video conferencing
- ☐ 1 meeting per semester
  - ☐ In person, ☐ Over the phone, ☐ Web / video conferencing

Meeting ABET Criteria

Please rate the following statements as they relate to your proposed project:

| On this project, students will need to apply knowledge of mathematics, science, and engineering |
|-----------------------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☑ 4 |

| This project gives students an opportunity to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability |
|---------------------------------------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☑ 4 |

| This project involves students from a variety of programs, i.e., CprE, EE, and SE |
|-----------------------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☑ 4 |

| This project requires students to identify, formulate, and solve engineering problems |
|-----------------------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☑ 4 |

| This project gives students an opportunity to use the techniques, skills, and modern engineering tools necessary for engineering practice |
|-----------------------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☑ 4 |
Project Approval – for use by ECpE Senior Design Committee

☑️ Approved: sddec18-proj026

☐ Project Assigned:

☐ Advisor(s) Assigned:
Client/Company/Organization: Principal Global Investors

Submitter Name: Joseph Byrum Email: byrum.joe@principal.com

Project Contact: Joseph Byrum Email: byrum.joe@principal.com

Project Title: Asset management - Financial Factor Discovery - "Momentum"

Project Abstract:

This project will allow you to exercise all your engineering skills and interests in a financial Big Data, Data Analytics, and Data Sciences project.

In financial markets, an investor must accept additional risk to achieve additional expected returns. This type of risk is often categorized into what are called risk premia or risk factors. For example, investing in smaller companies has historically led to higher returns than larger companies, but at the cost of additional variance of the returns. This risk factor is known as MOMENTUM.

Investment strategies based on these risk factors are known as Factor-Based Investing. These strategies are becoming increasingly popular and form the backbone of Principal Global Equities’ investment process.

To improve our factor-based process, you will research two areas:
- Factor performance forecasting: How will each risk factor perform in the next time period?
- Factor-based portfolio optimization: What overall risk factor exposures will lead to the highest risk-adjusted returns?

The project work is comprised of three main parts. First, you will study and measure the current forecasting process and define a model validation procedure. Next, you will research and test new modeling methods. Finally, you will use the predictions from your models to create optimal factor-based portfolios. Each of these steps is discussed in more detail below.

Expected Deliverables:

Part 1: Current State Analysis

1. Review and document all aspects of the current forecasting process including: inputs, model, parameter tuning, and performance. This will serve as a baseline for comparing new methods.

2. Create a standard process to estimate out-of-sample error. Choose split and error metric.

Part 2: Algorithm Exploration

1. Define list of algorithms to explore and associated tuning parameters to consider

2. Research and test algorithms using standard process and metrics from Part 1

3. Test model combination methods like bagging, boosting, and stacking

4. Analyze and compare response types including both categorical and continuous representations
Desired Final Results

Part 1: Current State Analysis

1. Process map and documentation of current forecasting process
2. Documentation and reasoning for proposed validation procedure
3. Performance report of current model using proposed validation procedure

Part 2: Algorithm Exploration

1. Documentation and quantitative results of all explored modeling methods.
2. Quantitative comparison of response types (categorical vs. continuous)
3. Comparison “matrix” of all methods using the following criteria:
   - Predictive accuracy
   - Interpretability
   - Computational complexity
   - Other criteria proposed by team
4. Final recommendations and barriers to implementing recommended methodology
5. Model prototype of recommended algorithm written in R or python

Business Impact

1. Good understanding of current process and areas of improvement for Principal stakeholders and project team
2. Clearly defined framework for comparing new modeling methods to current process leading to more efficient and impactful research
3. Improved forecast accuracy leading to better risk premia and asset selection
4. Increased portfolio returns, reduced risk
5. Establish PGI as a leader in quantitative, data-driven financial products
6. Potentially higher risk-adjusted returns
7. Foundational research that can be extended to multi-asset class portfolios

Specialized Resources Provided by Client:
PGI will provide all relevant subject matter expertise necessary to enable project success
Senior Design Project Proposal Form

Anticipated Cost: ________________________________  Financial Resources Provided by Client: project success

Preferred Students for the Project:

☑ Electrical Engineering
☑ Computer Engineering
☑ Software Engineering
☐ Other: Strong big data, data analytics, quantitative, and mathematical acumen desired

Anticipated Client Interaction (estimate):

☑ 1 meeting per week
☐ In person, ☐ Over the phone, ☐ Web / video conferencing

☐ 1 meeting per month
☐ In person, ☐ Over the phone, ☐ Web / video conferencing

☐ 2 or more meetings per month
☐ In person, ☐ Over the phone, ☐ Web / video conferencing

☐ 1 meeting per semester
☐ In person, ☐ Over the phone, ☐ Web / video conferencing

Meeting ABET Criteria

Please rate the following statements as they relate to your proposed project:

0 – Not at all  1 – A Little  2 – Somewhat  3 – A Lot  4 – Completely

On this project, students will need to apply knowledge of mathematics, science, and engineering

☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

This project gives students an opportunity to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

☐ 0  ☐ 1  ☐ 2  ☑ 3  ☐ 4

This project involves students from a variety of programs, i.e., CprE, EE, and SE

☐ 0  ☐ 1  ☐ 2  ☑ 3  ☑ 4

This project requires students to identify, formulate, and solve engineering problems

☐ 0  ☐ 1  ☐ 2  ☑ 3  ☑ 4

This project gives students an opportunity to use the techniques, skills, and modern engineering tools necessary for engineering practice

☐ 0  ☐ 1  ☐ 2  ☑ 3  ☑ 4

Project Approval – for use by ECpE Senior Design Committee
☑ Approved: sddec18-proj027

☐ Project Assigned: ________________________________

☐ Advisor(s) Assigned: ________________________________
Client/Company/Organization:  Prof. Hongwei Zhang @ ISU

Submitter Name:  Hongwei Zhang  Email:  hongwei@iastate.edu

Project Title:

IoT/CPS Wireless Networking Systems

Project Abstract:

Tightly integrating sensing, networking, computing, and control with physical systems and processes, Internet of Things (IoT) and cyber-physical systems (CPS) represent the third-wave of Internet evolution, following the first-wave of WWW applications and the second-wave of social networking. IoT/CPS are expected to transform the physical world around us and the way we interact with it, and they are instrumental enablers for connected and automated vehicles, precision agriculture, smart power grid, smart health, smart public safety, and so on.

A foundation for the IoT/CPS vision is trustworthy real-time wireless networking. Despite over a century of practice in wireless systems, we are still at the infancy of IoT/CPS wireless networking, and there exist ample opportunities to innovate and to lead the evolution of IoT/CPS wireless networking solutions and their applications. Through this project, students will have the opportunity to develop transformative IoT/CPS wireless solutions and explore their real-world applications in smart transportation, smart agriculture, smart grid, and so on. Students will also have the opportunity to develop wireless innovation platforms that enable prototyping, demonstration, and real-world deployment of the developed IoT/CPS wireless solutions.

Students will work as a team and with Prof. Hongwei Zhang who is an expert in IoT/CPS. Information about Prof. Zhang’s work can be found at http://www.ece.iastate.edu/~hongwei/.

Expected Deliverables:

The project will be executed according to the following roadmap:
* January 2018: survey IoT/CPS wireless solutions and open innovation platforms
* February - April, 2018: development of the IoT/CPS wireless innovation platform (e.g., wireless hardware and software systems, systems integration architecture, and platform deployment and operation plan)
* May - August, 2018: refinement and deployment of the wireless innovation platform
* September - November, 2018: prototyping of IoT/CPS wireless solutions using the developed innovation platform
* December, 2018: demonstration and report

Specialized Resources Provided by Client:

Hardware and software components for the IoT/CPS open innovation platform, IoT/CPS wireless algorithms

Research fund to support the project (e.g., equipment, personnel)

Anticipated Cost:  

Financial Resources Provided by Client:  
Senior Design Project Proposal Form

Preferred Students for the Project:
- ☑ Electrical Engineering
- ☑ Computer Engineering
- ☑ Software Engineering
- ☐ Other:

Other Special Skills: Background in wireless/computer networks and software development; willingness to learn; teamwork.

Anticipated Client Interaction (estimate):
- ☐ 1 meeting per week
  - ☐ In person, ☐ Over the phone, ☑ Web / video conferencing
- ☐ 1 meeting per month
  - ☐ In person, ☐ Over the phone, ☑ Web / video conferencing
- ☑ 2 or more meetings per month
  - ☑ In person, ☐ Over the phone, ☑ Web / video conferencing
- ☐ 1 meeting per semester
  - ☐ In person, ☐ Over the phone, ☑ Web / video conferencing

Meeting ABET Criteria

Please rate the following statements as they relate to your proposed project:

0 – Not at all   1 – A Little   2 – Somewhat   3 – A Lot   4 – Completely

On this project, students will need to apply knowledge of mathematics, science, and engineering
- ☐ 0   ☑ 1   ☐ 2   ☐ 3   ☑ 4

This project gives students an opportunity to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- ☐ 0   ☑ 1   ☐ 2   ☐ 3   ☑ 4

This project involves students from a variety of programs, i.e., CprE, EE, and SE
- ☐ 0   ☑ 1   ☐ 2   ☑ 3   ☐ 4

This project requires students to identify, formulate, and solve engineering problems
- ☐ 0   ☑ 1   ☐ 2   ☑ 3   ☑ 4

This project gives students an opportunity to use the techniques, skills, and modern engineering tools necessary for engineering practice
- ☐ 0   ☑ 1   ☐ 2   ☑ 3   ☑ 4

Project Approval – for use by ECpE Senior Design Committee

☑ Approved:   sddec18-proj028

☐ Project Assigned:   

☐ Advisor(s) Assigned:   

Senior Design Project Proposal Form

Client/Company/Organization: Siemens - Dresser-Rand

Submitter Name: Alan Menke Email: alan.menke@Siemens.com

Project Contact: Email:

Project Title: Applications Engineer

Project Abstract:
Siemens Power and Gas is using outdated FORTRAN software to estimate cost for custom built steam turbines. The software references ~4000 part numbers that require manual updates in an access database making maintaining and updating the costing database impractical. A solution is needed to make the cost updates more practical and less time consuming. This will allow us to better track and implement cost reduction measures that have been implemented recently as well as maintain our estimation tool as cost change.

The project should include:
- Review of the existing software and cost database with a recommendation for a future state software and database structure.
- A plan to reduce the quantity of part numbers and simplify the costing update process.
- Submit a plan to link the costing database to the steam turbine selection tools.
  This could use the existing code or new code could be developed.

Expected Deliverables:
Flow chart for the future state of cost updating process. May 10, 2018
Draft of code / detailed process to be used for future state cost updates Fall 2018

Specialized Resources Provided by Client:
Siemens will provide access to the software design company and code used in the updated steam turbine selection tool.

Anticipated Cost: Financial Resources Provided by Client:

Preferred Students for the Project:
☐ Electrical Engineering Other Special Skills: Visual Basic
☐ Computer Engineering C++
☑ Software Engineering basic knowledge of FORTRAN
☐ Other:

Anticipated Client Interaction (estimate):
☑ 1 meeting per week
☐ In person, ☑ Over the phone, ☐ Web / video conferencing
☐ 1 meeting per month
☐ In person, ☐ Over the phone, ☐ Web / video conferencing
☐ 2 or more meetings per month
Meeting ABET Criteria

Please rate the following statements as they relate to your proposed project:

<table>
<thead>
<tr>
<th>On this project, students will need to apply knowledge of mathematics, science, and engineering</th>
<th>0 – Not at all</th>
<th>1 – A Little</th>
<th>2 – Somewhat</th>
<th>3 – A Lot</th>
<th>4 – Completely</th>
</tr>
</thead>
</table>
| ☐ 0 ☐ 1 ☑ 2 ☐ 3 ☐ 4

This project gives students an opportunity to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

| ☐ 0 ☐ 1 ☐ 2 ☐ 3 ☑ 4 |

This project involves students from a variety of programs, i.e., CprE, EE, and SE

| ☑ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 |

This project requires students to identify, formulate, and solve engineering problems

| ☐ 0 ☐ 1 ☐ 2 ☑ 3 ☐ 4 |

This project gives students an opportunity to use the techniques, skills, and modern engineering tools necessary for engineering practice

| ☐ 0 ☐ 1 ☐ 2 ☑ 3 ☐ 4 |

Project Approval – for use by ECoE Senior Design Committee

☑ Approved:

sddec18-proj029

☐ Project Assigned:

___________________________________________

☐ Advisor(s) Assigned:

___________________________________________

___________________________________________
Client/Company/Organization: Optical Operations

Submitter Name: Andrew Guillemette  
Email: aguillemette@opticaloperations.com

Project Contact: Andrew Guillemette  
Email: aguillemette@opticaloperations.com

Project Title:  
IoT Passive monitoring for assisted living homes

Project Abstract:

The goal for this project is to measure 4 areas of interest that directly correspond to the health of seniors, these areas are: Eating, Sleeping, Hygiene, and falls. Our goal is to combine several passive sensors that will help predict and report the health of seniors. These sensors include digital flow valves, load cells, motion detectors, smart sockets, wireless door contacts, and thermostat. By the end of the year the goal is to collect and store data in a cloud platform where a future students or engineers can apply machine learning algorithms. All sensors must be able to send data to a central hub. During the design phase it is important to keep in mind that even though we are prototyping we always need to be conscious of feasibility and practicality.

Expected Deliverables:

The first semester schedule would be as follows. Once we meet with the students we will have them refine the schedule into weekly tasks/reports. Optical Operations also likes to have weekly meetings with the students for updates and to answer/clarify any questions the students might have.

January:
- Meet with client to discuss deliverables
- Set up first semester milestones
- Set up weekly meeting time
- Create a Slack profile
- Assign roles and tasks to team members

February:
- Research sensors
- Generate software and hardware flow charts

March:
- Present list of compatible sensors to buy
- Start designing tests for the equipment
- Set up Cloud server

April:
- Test sensors
- Collect data

May:
- Set up second semester goals
- Prove data can be collected at the same time
- Present first semester work

During the second semester the students will bring these sensors into a test environment to collect data. We will work on setting up test scenarios and provide a great demo for the final presentation. The end result is to have several sensors collect and send data to a server. There if time the students can work on parsing the data so our machine learning algorithm can access it easily.
Specialized Resources Provided by Client:

Optical Operations has a work-space for the students, located in the Ames industrial park. All tools and hardware will be provided by the client.

Financial Resources Provided by Client:

Any materials needed for this project will be provided by the Optical Operations. Students must clearly state why an item is needed and explain why it is the correct one. Optical Operations will not allow the success of this project to be limited by any financial constraints.

Preferred Students for the Project:

- Electrical Engineering
- Computer Engineering
- Software Engineering
- Other:

Other Special Skills: Knowledge of Zigbee, Python, Raspberry Pi's, Sensor integration, and Google cloud server

Anticipated Client Interaction (estimate):

- 1 meeting per week
  - In person, ☑ Over the phone, ☐ Web / video conferencing
- 1 meeting per month
  - In person, ☐ Over the phone, ☑ Web / video conferencing
- 2 or more meetings per month
  - In person, ☐ Over the phone, ☑ Web / video conferencing
- 1 meeting per semester
  - In person, ☐ Over the phone, ☐ Web / video conferencing

Meeting ABET Criteria

Please rate the following statements as they relate to your proposed project:

0 – Not at all  1 – A Little  2 – Somewhat  3 – A Lot  4 – Completely

On this project, students will need to apply knowledge of mathematics, science, and engineering

☑ 4
This project gives students an opportunity to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

☐ 0  ☐ 1  □ 2  □ 3  ☑ 4

This project involves students from a variety of programs, i.e., CprE, EE, and SE

☐ 0  □ 1  □ 2  □ 3  ☑ 4

This project requires students to identify, formulate, and solve engineering problems

☐ 0  □ 1  □ 2  □ 3  ☑ 4

This project gives students an opportunity to use the techniques, skills, and modern engineering tools necessary for engineering practice

☐ 0  □ 1  □ 2  □ 3  ☑ 4

Project Approval – for use by ECpE Senior Design Committee

☑  Approved:  sddec18-proj030

☐  Project Assigned:  

☐  Advisor(s) Assigned:  

_____________________________
Client/Company/Organization: Iowa State University

Submitter Name: Simon Laflamme
Email: laflamme@iastate.edu

Project Title: Portable DAQ for dogs

Project Abstract:
We are currently developing a biosensor for monitoring large strain on dog skin. We plan to install the sensor on live animals in a near future, and therefore need to be capable of acquiring data directly on the animal. The objective is to develop a DAQ capable of doing so. The DAQ must read and collect resistance data, small and lightweight for an installation on a collar, and could be wired to the sensor.

Expected Deliverables:
The DAQ by the end of the semester

Specialized Resources Provided by Client:
Sensors

Anticipated Cost: Financial Resources Provided by Client: Up to $200

Preferred Students for the Project:
☑ Electrical Engineering
☐ Computer Engineering
☐ Software Engineering
☐ Other:

Anticipated Client Interaction (estimate):
☐ 1 meeting per week
   ☐ In person, ☐ Over the phone, ☐ Web / video conferencing
☑ 1 meeting per month
   ☑ In person, ☐ Over the phone, ☐ Web / video conferencing
☐ 2 or more meetings per month
   ☐ In person, ☐ Over the phone, ☐ Web / video conferencing
☐ 1 meeting per semester
   ☐ In person, ☐ Over the phone, ☐ Web / video conferencing

Meeting ABET Criteria

Please rate the following statements as they relate to your proposed project:

☐ 0 – Not at all  ☐ 1 – A Little  ☐ 2 – Somewhat  ☐ 3 – A Lot  ☐ 4 – Completely
On this project, students will need to apply knowledge of mathematics, science, and engineering

☐   ☐   ☐   ☐   ☑ 4

This project gives students an opportunity to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

☐   ☐   ☐   ☐   ☑ 4

This project involves students from a variety of programs, i.e., CprE, EE, and SE

☐   ☐   ☐   ☐   ☑ 4

This project requires students to identify, formulate, and solve engineering problems

☐   ☐   ☐   ☐   ☑ 4

This project gives students an opportunity to use the techniques, skills, and modern engineering tools necessary for engineering practice

☐   ☐   ☐   ☐   ☑ 4

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Project Approval – for use by ECpE Senior Design Committee

☑   Approved:  sddec18-proj031

☐   Project Assigned:

☐   Advisor(s) Assigned:
Client/Company/Organization: Workiva

Submitter Name: Alex Kharbush Email: alex.kharbush@workiva.com

Project Title:
Use machine learning to predict relevant support content based on historical user interactions.

Project Abstract:

Given a large data set of users progression through the Wdesk app, we want to predict what relevant help articles our customers may need.

ML models maybe trained locally but ideally trained on AWS or GAE. Running the models in a docker container would also be a large win.

We would like code written in python. Students can easily the leverage http://scikit-learn.org/stable/ for ML examples and code support.

Solving this problem would provide our customers with better self help results and lessen the burden on our customer support staff.

If the students can provide a ML model that predicts with a 70% accuracy the most relevant help articles we would use the work in production. Additional work would be to define the top 10 most likely articles.

Data will be in the format of:

[Events], article_id, Success

[1,4,2,5,10], 234234234, 1
[1,4,2,5,10], 234234234, 1
[1,4,2,5,9], 445454545, 0
[1,4,2,5,9], 234234234, 0
[1,4,2,5,10], 453353555, 1

Additional data maybe added to the set. Code may be managed through github. This project is designed to improve ISU graduates chances of full time employment at Workiva, Amazon, Google or Facebook.

Expected Deliverables:

1st Semester should deliver a document that explains the process/approach used to generate one or more models, methods used to test the selected model and some prototype code running locally.

2nd semester: Working code, delivered via github, along with a document/presentation describing results, and areas for improvement.
Specialized Resources Provided by Client:
Project contact Alex Kharbush used to work at AWS in the machine learning group.

Anticipated Cost: ________________________  Financial Resources Provided by Client: AWS/GAE

Preferred Students for the Project:
☐ Electrical Engineering  Other Special Skills: Machine learning, Python or other ML Libs.
☐ Computer Engineering
☐ Software Engineering
☐ Other:

Anticipated Client Interaction (estimate):
☐ 1 meeting per week
   ☐ In person, ☐ Over the phone, ☐ Web / video conferencing
☐ 1 meeting per month
   ☐ In person, ☐ Over the phone, ☐ Web / video conferencing
☑ 2 or more meetings per month
   ☑ In person, ☐ Over the phone, ☐ Web / video conferencing
☐ 1 meeting per semester
   ☐ In person, ☐ Over the phone, ☐ Web / video conferencing

Meeting ABET Criteria

Please rate the following statements as they relate to your proposed project:

<table>
<thead>
<tr>
<th>0 – Not at all</th>
<th>1 – A Little</th>
<th>2 – Somewhat</th>
<th>3 – A Lot</th>
<th>4 – Completely</th>
</tr>
</thead>
<tbody>
<tr>
<td>On this project, students will need to apply knowledge of mathematics, science, and engineering</td>
<td>☐ 0</td>
<td>☐ 1</td>
<td>☐ 2</td>
<td>☐ 3</td>
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<td>This project gives students an opportunity to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability</td>
<td>☐ 0</td>
<td>☐ 1</td>
<td>☐ 2</td>
<td>☐ 3</td>
</tr>
<tr>
<td>This project involves students from a variety of programs, i.e., CprE, EE, and SE</td>
<td>☐ 0</td>
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<td>☐ 2</td>
<td>☐ 3</td>
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<td>This project requires students to identify, formulate, and solve engineering problems</td>
<td>☐ 0</td>
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<td>☐ 2</td>
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</tr>
<tr>
<td>This project gives students an opportunity to use the techniques, skills, and modern engineering tools necessary for engineering practice</td>
<td>☐ 0</td>
<td>☐ 1</td>
<td>☐ 2</td>
<td>☐ 3</td>
</tr>
</tbody>
</table>

Project Approval – for use by ECpE Senior Design Committee
☑ Approved: sddec18-proj032

☐ Project Assigned:

☐ Advisor(s) Assigned:
Project Title:
Surface impact and location detection with NASA's SansEC (Sans Electrical Connection) sensor technology

Project Abstract:
Develop prototype of a surface impact and penetration location detection system using licensable NASA SansEC (Sans Electrical Connection) sensor technology. Project outputs and prototype capability goals:
• Develop medium with printed embedded sensor array (e.g., paper, plastic sheet)
• Identify when impact occurs and location (i.e., x-y coordinates on sheet)
• Communicate impact location coordinates to control platform
• Plot impact locations on reading device (e.g., computer screen, smartphone, tablet)

System components
• Thin film substrate with printed sensor or sensor array (i.e., detection medium)
• Sensor calibration and interrogation with antenna (magnetic field response measurement acquisition)
• Damage detection / sensor response detection software and machine learning algorithms
• Wireless communication to output / user interface (e.g., smartphone, iPad)

Thin-film / paper substrate (detection medium)
• 2’x2’ or 2’x3’ with goal of eventually being able to expand to 3’x4’
• Printed conductive ink sensor array and ink antenna embedded within sensor array medium (option 1)
• Separate antenna within a structure framing the detection medium (option 2)

Sensor array design and calibration
• Develop ideal sensor or sensor array design and supported detection precision
• Develop antenna layout and detection approach
• Calibrate sensor or sensor array to determine detection location using network analyzer antennae, and associated equipment

Data acquisition, interrogation, and management
• Interrogate sensor array after each impact with antenna
• Use antenna feedback / network analyzer input, machine learning algorithms, etc. to determine impact location
• Store collected data and present on user readable medium (e.g., computer, tablet)

A more detailed PowerPoint overview of the concept and project is available upon request and has been shared with Cary Novak.

Expected Deliverables:
Ideally a prototyped system consisting of 1) a conductive ink printed 8” x 11” sensor array, 2) an algorithm solution...
Senior Design Project Proposal Form

for identifying the impact’s time and location, and 3) an output media capable of showing the impact location on a screen of a PC, iPhone / iPad, etc. Timing: Semester 1 - printed array and basic impact detection on network analyzer; Semester 2 - detection algorithm and output.

Specialized Resources Provided by Client:
Licensee package from NASA consisting of technology overview, sample sensor(s), and base detection software. Awaiting confirmation of details of what is provided.

Anticipated Cost: ___________________________  
Financial Resources Provided by Client: $2,500 (some flexibility depending on project needs)

Preferred Students for the Project:

☑ Electrical Engineering
☑ Computer Engineering
☑ Software Engineering

Other Special Skills: Interest in sensor and antenna technologies, network analyzer knowledge, software development, machine learning, etc. Potential resource needs: conductive ink printer, network analyzer, access to software development languages, etc.

Anticipated Client Interaction (estimate):

☐ 1 meeting per week
   □ In person, □ Over the phone, □ Web / video conferencing

☐ 1 meeting per month
   □ In person, □ Over the phone, □ Web / video conferencing

☑ 2 or more meetings per month
   □ In person, ☑ Over the phone, □ Web / video conferencing

☐ 1 meeting per semester
   □ In person, □ Over the phone, □ Web / video conferencing

Meeting ABET Criteria

Please rate the following statements as they relate to your proposed project:

0 – Not at all  1 – A Little  2 – Somewhat  3 – A Lot  4 – Completely

On this project, students will need to apply knowledge of mathematics, science, and engineering

☐ 0  ☑ 1  ☑ 2  ☑ 3  ☑ 4

This project gives students an opportunity to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

☐ 0  ☑ 1  ☑ 2  ☑ 3  ☑ 4

This project involves students from a variety of programs, i.e., CprE, EE, and SE

☐ 0  ☑ 1  ☑ 2  ☑ 3  ☑ 4
This project requires students to identify, formulate, and solve engineering problems
☐ 0  ☑ 1  ☐ 2  ☐ 3  ☑ 4

This project gives students an opportunity to use the techniques, skills, and modern engineering tools necessary for engineering practice
☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

Project Approval – for use by ECpE Senior Design Committee

☑ Approved: sddec18-proj033
☐ Project Assigned:
☐ Advisor(s) Assigned:
Senior Design Project Proposal Form

Client/Company/Organization: Jiming Song
Submitter Name: Jiming Song Email: jisong@iastate.edu
Project Title: Ground Penetration Radar (GPR)

Project Abstract:
Vermeer in Pella, Iowa donated a ground penetration radar (GPR) system with 14 antennas. The objective of this project is to upgrade the GPR, in both computer hardware and software. The current system is about 2 m. The goal is to use several existing antennas to build smaller GPR. Students with backgrounds on RF, or computer hardware or software are welcome to work on this project.

Expected Deliverables:
Upgraded ground penetration radar (GPR) and demostration

Specialized Resources Provided by Client:
The ground penetration radar (GPR) donated by Vermeer.

Anticipated Cost: Financial Resources Provided by Client: None

Preferred Students for the Project:
☑ Electrical Engineering ☑ Computer Engineering
☑ Software Engineering ☐ Other:

Anticipated Client Interaction (estimate):
☑ 1 meeting per week
☑ In person, ☐ Over the phone, ☐ Web / video conferencing
☐ 1 meeting per month
☐ In person, ☐ Over the phone, ☐ Web / video conferencing
☐ 2 or more meetings per month
☐ In person, ☐ Over the phone, ☐ Web / video conferencing
☐ 1 meeting per semester
☐ In person, ☐ Over the phone, ☐ Web / video conferencing

Meeting ABET Criteria
Please rate the following statements as they relate to your proposed project:

0 – Not at all  1 – A Little  2 – Somewhat  3 – A Lot  4 – Completely
On this project, students will need to apply knowledge of mathematics, science, and engineering ☐ 0 ☐ 1 ☐ 2 ☐ 3 ☑ 4

This project gives students an opportunity to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability ☐ 0 ☐ 1 ☐ 2 ☐ 3 ☑ 4

This project involves students from a variety of programs, i.e., CprE, EE, and SE ☐ 0 ☐ 1 ☐ 2 ☐ 3 ☑ 4

This project requires students to identify, formulate, and solve engineering problems ☐ 0 ☐ 1 ☐ 2 ☐ 3 ☑ 4

This project gives students an opportunity to use the techniques, skills, and modern engineering tools necessary for engineering practice ☐ 0 ☐ 1 ☐ 2 ☐ 3 ☑ 4

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**Project Approval – for use by ECpE Senior Design Committee**

☑ Approved: sddec18-proj034

☐ Project Assigned: 

☐ Advisor(s) Assigned: 
Client/Company/Organization:  Greiner Jennings Holdings

Submitter Name:  Taylor Greiner
Email:  taylor@greinerjennings.com

Project Title:  IoT Remote Monitoring Mobile App for Commercial Appliances

Project Abstract:

The internet of things is expected to have 50 billion devices on the internet by 2020. Companies developing these devices need engineers with experience in IoT development and knowledge of how to integrate these devices with mobile applications. This project will help deepen students’ knowledge in both IoT and mobile development. Greiner Jennings Holdings is looking to have a mobile app and IoT application prototyped to control, monitor, and reserve commercial appliances. Students will be able to choose the mobile platform of the app, as well as the IoT stack, such as AWS IoT, used to control the appliance controller. The IoT device must be able to monitor whether the appliance is currently being used. The mobile app will be able to check the usage status of appliances at different locations and allow users to reserve different appliances remotely from the app for a fee. A reservation will lock the appliance until a number, generated from the app, is entered into the appliance or the reservation time expires.

Expected Deliverables:

Mobile app to check usage, reserve appliances, and charge users for reservation, IoT device to lock appliance remotely and unlock with a reservation code

Specialized Resources Provided by Client:

In the spring, an appliance controller will be provided for testing and validation for the team. In the fall, a complete appliance will be available for the team to further develop the prototype.

Anticipated Cost:  
Financial Resources Provided by Client:  500

Preferred Students for the Project:

☐ Electrical Engineering
☐ Computer Engineering
☐ Software Engineering
☐ Other:

Other Special Skills:  General experience developing mobile applications, working with microcontrollers or single board computers (arduino, raspberry pi, beaglebone black), Cloud computing experience a plus

Anticipated Client Interaction (estimate):

☐ 1 meeting per week
   ☐ In person, ☐ Over the phone, ☐ Web / video conferencing
☐ 1 meeting per month
   ☐ In person, ☐ Over the phone, ☐ Web / video conferencing
☑ 2 or more meetings per month
   ☐ In person, ☐ Over the phone, ✓ Web / video conferencing
Senior Design Project Proposal Form

☐ 1 meeting per semester
  ☐ In person, ☐ Over the phone, ☐ Web / video conferencing

Meeting ABET Criteria

Please rate the following statements as they relate to your proposed project:

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</thead>
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On this project, students will need to apply knowledge of mathematics, science, and engineering

☐ 0  ☐ 1  ☐ 2  ☑ 3  ☐ 4

This project gives students an opportunity to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

This project involves students from a variety of programs, i.e., CprE, EE, and SE

☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

This project requires students to identify, formulate, and solve engineering problems

☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

This project gives students an opportunity to use the techniques, skills, and modern engineering tools necessary for engineering practice

☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

Project Approval – for use by ECpE Senior Design Committee

☑ Approved:  sddec18-proj035

☐ Project Assigned: ________________________________

☐ Advisor(s) Assigned: ________________________________
Senior Design Project Proposal Form

Client/Company/Organization: Principal Financial Group/Principal Global Investors

Submitter Name: Jessica Burns
Email: burns.jessica@principal.com

Project Contact: Email:

Project Title: Principal Funds Distribution - Trade and Asset Resolution Efficiencies

Project Abstract:
Our project can be described in two parts of a process that has opportunity to be re-engineered for efficiency using modern technology as well as enhanced with automated tests. Part 1 is first priority and Part 2 would be an additional opportunity if time allows.

Part 1: Millions of transactions are received each day from external data providers, loaded to a database and enriched by a set of business rules. The current technology is a combination of Informatica and Java on a mainframe DB2 platform. The opportunity here is to modernize the technology and create a rules engine complete with automated tests. Our intended state is composed of a Rules Engine that can be bundled alongside a Service Oriented Architecture. This solution provides high reliability and scales with load to make Rules readily available to multiple platforms and provide consistency and uniformity. The engine should provide Administration and Management of Rules by business users - also providing security limitations based on user roles. A solution positioned for cloud hosting would be ideal.

Part 2: As the set of business rules is applied, transactions that do not pass the rules are set to error status and presented in an application for our Operations team to manually resolve. The opportunity here is to evaluate the use of this application and improve the navigation and screen layouts as well as solve for any missing capabilities that would improve efficiency. We seek delivery of a streamlined/modernized front end concept via a focused UX Design effort to identify users, roles and processes for the existing Resolution application. This effort can utilize Rapid Prototyping, Wireframing, or any other UX based concepts to help drive the effort.

Expected Deliverables:
Spring Semester 1. Present a proposal by the end of semester for Part 1. 2. If time allows, begin looking at Part 2.
Fall Semester: Work with our development team to begin executing on the proposal for Part 1.

Specialized Resources Provided by Client:

Anticipated Cost: __________________________ Financial Resources Provided by Client: __________________________

Preferred Students for the Project:
☐ Electrical Engineering
✓ Computer Engineering
✓ Software Engineering
☐ Other:

Other Special Skills:
Senior Design Project Proposal Form

Anticipated Client Interaction (estimate):
☑ 1 meeting per week
   ☑ In person, □ Over the phone, □ Web / video conferencing
□ 1 meeting per month
   □ In person, □ Over the phone, □ Web / video conferencing
□ 2 or more meetings per month
   □ In person, □ Over the phone, □ Web / video conferencing
□ 1 meeting per semester
   □ In person, □ Over the phone, □ Web / video conferencing

Meeting ABET Criteria

Please rate the following statements as they relate to your proposed project:

0 – Not at all  1 – A Little  2 – Somewhat  3 – A Lot  4 – Completely

On this project, students will need to apply knowledge of mathematics, science, and engineering
☐ 0  ☑ 1  ☐ 2  ☑ 3  ☐ 4

This project gives students an opportunity to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
☐ 0  ☑ 1  ☐ 2  □ 3  ☑ 4

This project involves students from a variety of programs, i.e., CprE, EE, and SE
☐ 0  ☑ 1  ☐ 2  ☑ 3  ☐ 4

This project requires students to identify, formulate, and solve engineering problems
☐ 0  ☑ 1  ☐ 2  ☑ 3  ☐ 4

This project gives students an opportunity to use the techniques, skills, and modern engineering tools necessary for engineering practice
☐ 0  ☑ 1  ☐ 2  ☑ 3  ☑ 4

Project Approval – for use by ECpE Senior Design Committee

☑ Approved:  sddec18-proj036
☐ Project Assigned:
☐ Advisor(s) Assigned:
Client/Company/Organization: Iowa State University

Submitter Name: Lotfi ben Othmane Email: othmane@iastate.edu

Project Contact: Lotfi ben Othmane Email: othmane@iastate.edu

Project Title: Implementation of V2V Communication for LTE Direct

Project Abstract:
Recently manufactured cars embed a module that allows the vehicles to communicate using short range technology. This technology is being replaced by a recent one: LTE Direct. The goal of the project is to upgrade an implementation of V2V communication to LTE direct. The project is to be published as open source.

Expected Deliverables:
1- Installation of the current software on appropriate devices.
2- Develop a prototype for communication using Direct LTE.
3- Upgrade the communication modules to support Direct LTE.
4- Extend the software to exchange V2V messages that conforms to standards.

Specialized Resources Provided by Client:
The hardware and code will be provided by the client.

Anticipated Cost: Financial Resources Provided by Client:

Preferred Students for the Project:
☐ Electrical Engineering
☑ Computer Engineering
☑ Software Engineering
☐ Other:

Other Special Skills:

Anticipated Client Interaction (estimate):
☑ 1 meeting per week
  ☑ In person, ☐ Over the phone, ☐ Web / video conferencing
☐ 1 meeting per month
  ☐ In person, ☐ Over the phone, ☐ Web / video conferencing
☐ 2 or more meetings per month
  ☐ In person, ☐ Over the phone, ☐ Web / video conferencing
☐ 1 meeting per semester
  ☐ In person, ☐ Over the phone, ☐ Web / video conferencing

Meeting ABET Criteria
Please rate the following statements as they relate to your proposed project:

0 – Not at all   1 – A Little   2 – Somewhat   3 – A Lot   4 – Completely

On this project, students will need to apply knowledge of mathematics, science, and engineering
☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

This project gives students an opportunity to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

This project involves students from a variety of programs, i.e., CprE, EE, and SE
☐ 0  ☐ 1  ☐ 2  ☑ 3  ☐ 4

This project requires students to identify, formulate, and solve engineering problems
☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

This project gives students an opportunity to use the techniques, skills, and modern engineering tools necessary for engineering practice
☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

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**Project Approval – for use by ECpE Senior Design Committee**

☑ Approved: sddc18-proj037

☐ Project Assigned: 

☐ Advisor(s) Assigned: 
Serverless Computing Migration

Serverless computing, as embodied by IBM Cloud Functions (formerly IBM OpenWhisk), Amazon's AWS Lambda, and Google Serverless, is rapidly emerging as an attractive alternative to traditional cloud computing due to its lower costs, increased agility, and lower barrier to entry for cloud clients and improved fine-grained computational resource management for cloud service providers. The goal of this project would be to create a software engineering tool that can help existing software migrate to the serverless environment.

The tool when complete would analyze the computer code of the software and recommend pieces of the code that are suitable for the serverless computing environment to the developer. The tool would also provide the rationale behind its recommendations. If the developer chooses to migrate their application, the tool would generate code to perform the migration. For simplicity, this project would focus on the computer code written in the Java programming language, but the techniques should be generalizable.

Expected Deliverables:

Three deliverables would be expected:
1. An approach for analyzing existing Java code to identify portions of the code that could be migrated, and its implementation in a software tool.
2. An approach for explaining the rationale behind the tool's recommendation and its implementation in the same software tool.
3. An approach for rewriting existing computer code to use Serverless computing service and its implementation in the same software tool. For simplicity, we will only target IBM Cloud Functions at first.

Specialized Resources Provided by Client:

Anticipated Cost: __________________________ Financial Resources Provided by Client: __________________________

Preferred Students for the Project:

☐ Electrical Engineering
☐ Computer Engineering
☐ Software Engineering
☐ Other:

Other Special Skills: This project is aimed at students who are excellent programmers with a strong background in computer science topics such as discrete mathematics, algorithms, and theory of computation. Working knowledge of programming language implementation, e.g. compilers, interpreters, is expected. Preferred: knowledge of program analysis techniques.
Anticipated Client Interaction (estimate):

☐ 1 meeting per week
   ☐ In person, ☐ Over the phone, ☐ Web / video conferencing
☐ 1 meeting per month
   ☐ In person, ☐ Over the phone, ☐ Web / video conferencing
☑ 2 or more meetings per month
   ☑ In person, ☐ Over the phone, ☐ Web / video conferencing
☐ 1 meeting per semester
   ☐ In person, ☐ Over the phone, ☐ Web / video conferencing

Meeting ABET Criteria

Please rate the following statements as they relate to your proposed project:

On this project, students will need to apply knowledge of mathematics, science, and engineering
☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

This project gives students an opportunity to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

This project involves students from a variety of programs, i.e., CprE, EE, and SE
☐ 0  ☐ 1  ☑ 2  ☐ 3  ☐ 4

This project requires students to identify, formulate, and solve engineering problems
☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

This project gives students an opportunity to use the techniques, skills, and modern engineering tools necessary for engineering practice
☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

Project Approval – for use by ECpE Senior Design Committee

☑ Approved: sddec18-proj038
☐ Project Assigned:
☐ Advisor(s) Assigned:
Project Title:
Runtime Verification for Capsule-oriented Programming

Project Abstract:
Modern software systems tend to be distributed, event-driven, and asynchronous, often requiring components to maintain multiple threads for message and event handling. In addition, there is increasing pressure on developers to introduce concurrency into applications in order to take advantage of multicore and many-core processors to improve performance. Yet concurrent programming stubbornly remains difficult and error-prone. To address these issues, the invention and refinement of better abstractions is needed: that can hide the details of concurrency from the programmer and allow them to focus on the program logic. Over the last few years, Rajan and colleagues have developed a comprehensive and multifaceted approach to the challenges of concurrent programming called capsule-oriented programming. A central goal of capsule-oriented programming is to provide tools to enable programmers to simply do what they do best, that is, to describe a system in terms of its modular structure and write sequential code to implement the operations of those modules using a new abstraction that we call capsule. A capsule is like a process; it defines a set of public operations, and also serves as a memory region, or ownership domain, for some set of ordinary objects. To the programmer, inter-capsule calls look like ordinary method calls. There are no explicit threads or synchronization locks. Capsule-oriented programs get implicit parallelism, where beneficial, due to a compilation strategy that we call modularization-guided parallelism. Capsule-oriented programming eliminates two classes of concurrency errors: sequential inconsistency, and race conditions due to shared data. We have realized basic ideas behind capsule-oriented programming as an annotation processing framework that we call @PaniniJ (https://paninij.github.io).

The goal of this project is to develop a runtime mechanism to check ownership properties of a capsule and implement that in the @PaniniJ software tool. This runtime mechanism, when active, will detect if the objects (Java object instances) owned by a capsule leave the scope of the capsule instance while still remaining accessible by the capsule instance that can cause potentially harmful data races. Key challenges would be to keep the runtime costs of such mechanisms low, preferably negligible and in keeping the false positives low.

Expected Deliverables:
Three deliverables would be expected:
1. An approach for checking ownership properties of capsule instances at runtime, and its implementation in the @PaniniJ framework.
2. A demonstration of the effectiveness of the technique by creating the @PaniniJ version of several medium-to-large Java open source software systems and testing the new @PaniniJ framework using these software systems.
3. An evaluation of (a) runtime performance, (b) precision of reported errors, (c) how often the runtime mechanism is invoked during the representative run of the open source software created above, and (d) average depth of the object graph that is transferred between capsules at runtime.

Specialized Resources Provided by Client:
Senior Design Project Proposal Form

Anticipated Cost: __________________________ Financial Resources Provided by Client: __________________________

Preferred Students for the Project:
☐ Electrical Engineering  
☑ Computer Engineering  
☑ Software Engineering  
☐ Other: __________________________

Other Special Skills: This project is aimed at students who are excellent programmers with a strong background in computer science topics such as discrete mathematics, algorithms, and theory of computation. Working knowledge of programming language implementation, e.g. compilers, interpreters, is expected. Preferred: knowledge of program analysis techniques.

Anticipated Client Interaction (estimate):
☐ 1 meeting per week
☐ In person, ☐ Over the phone, ☐ Web / video conferencing
☐ 1 meeting per month
☐ In person, ☐ Over the phone, ☐ Web / video conferencing
☑ 2 or more meetings per month
☑ In person, ☐ Over the phone, ☐ Web / video conferencing
☐ 1 meeting per semester
☐ In person, ☐ Over the phone, ☐ Web / video conferencing

Meeting ABET Criteria

Please rate the following statements as they relate to your proposed project:

0 – Not at all  1 – A Little  2 – Somewhat  3 – A Lot  4 – Completely

On this project, students will need to apply knowledge of mathematics, science, and engineering  ☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

This project gives students an opportunity to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability  ☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

This project involves students from a variety of programs, i.e., CprE, EE, and SE  ☐ 0  ☐ 1  ☑ 2  ☐ 3  ☐ 4

This project requires students to identify, formulate, and solve engineering problems  ☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

This project gives students an opportunity to use the techniques, skills, and modern engineering tools necessary for engineering practice  ☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

Project Approval – for use by ECpE Senior Design Committee

☑ Approved: sddec18-proj039
Senior Design Project Proposal Form

Client/Company/Organization: Danfoss Power Solutions
Submitter Name: Radek Kornicki  Email: rkornicki@danfoss.com
Project Contact: Radek Kornicki  Email: rkornicki@danfoss.com

Project Title:
Deep learning (neural networks) using radar to identify and track objects

Project Abstract:
- Pick a radar - suggested Vayyar (vayyar.com, walabot.com) or similar.
- We’re looking at the low cost level of hardware...
- IC & antenna, maybe this is just a dev kit
Choose a deep learning library and platform to work in
- For example TensorFlow, C++, and Microsoft Windows
Port data from radar to deep learning platform
Design a neural network to perform object classification
Train the neural network with examples of various objects
- For example “construction machines”, “cars”, and “human beings”
Tune the neural network appropriately to perform classification
Demonstrate the ability to identify objects
- For example maybe we train on construction equipment and human beings and demonstrate the ability to identify either arbitrarily

Can use camera as a secondary input device.

Expected Deliverables:
  first semester - selection of radar hardware and system setup with neural network platform
  second semester - object classification & deep learning

Specialized Resources Provided by Client:
- Radar kit(s) of Your choosing.
- Access to GPU server for deep learning.
- Necessary software licenses and etc...

Anticipated Cost:  Financial Resources Provided by Client: 5000

Preferred Students for the Project:
☑ Electrical Engineering
☑ Computer Engineering
☑ Software Engineering
☐ Other:

Anticipated Client Interaction (estimate):
☑ 1 meeting per week
☐ In person, ☐ Over the phone, ✓ Web / video conferencing
☐ 1 meeting per month
☐ In person, ☐ Over the phone, ☐ Web / video conferencing
☐ 2 or more meetings per month
☐ In person, ☐ Over the phone, ☐ Web / video conferencing
☐ 1 meeting per semester
☐ In person, ☐ Over the phone, ☐ Web / video conferencing

Meeting ABET Criteria

Please rate the following statements as they relate to your proposed project:

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<thead>
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On this project, students will need to apply knowledge of mathematics, science, and engineering ☐ 0 ☐ 1 ☐ 2 ☐ 3 ✓ 4

This project gives students an opportunity to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability ☐ 0 ☐ 1 ☐ 2 ☐ 3 ✓ 4

This project involves students from a variety of programs, i.e., CprE, EE, and SE ☐ 0 ☐ 1 ☐ 2 ☐ 3 ✓ 4

This project requires students to identify, formulate, and solve engineering problems ☐ 0 ☐ 1 ☐ 2 ☐ 3 ✓ 4

This project gives students an opportunity to use the techniques, skills, and modern engineering tools necessary for engineering practice ☐ 0 ☐ 1 ☐ 2 ☐ 3 ✓ 4

Project Approval – for use by ECpE Senior Design Committee

☐ Approved: sddec18-proj040
☐ Project Assigned: 
☐ Advisor(s) Assigned:
Senior Design Project Proposal Form

Client/Company/Organization: Danfoss Power Solutions

Submitter Name: Radek Kornicki  Email: rkornicki@danfoss.com

Project Contact: Radek Kornicki  Email: rkornicki@danfoss.com

Project Title:
Distributed mesh network for data collection and predictive analytics

Project Abstract:
Using embedded data acquisition system (provided by Danfoss) based on STM32 processors create a WiFi node of mesh network. Based on several of the aforementioned devices create a dynamically optimized mesh network for data acquisition (nodes can move in relation to each other).

Using commercially available cloud based solution create data post processing system allowing for data analytics with primary focus on predictive analytics (for example preventative maintenance).

Expected Deliverables:
First semester focus on the mesh network and dynamic network optimization.
Second semester - focus on cloud based data analytics.

Specialized Resources Provided by Client:
Understanding of mesh networks and mesh network optimization
Interest in big data analytics, predictive analytics, IOT

Anticipated Cost: Financial Resources Provided by Client: 5000

Preferred Students for the Project:
☑ Electrical Engineering
☑ Computer Engineering
☑ Software Engineering
☐ Other:

Other Special Skills: Embedded systems
Cloud data analytics

Anticipated Client Interaction (estimate):
☑ 1 meeting per week
   ☑ In person, ☐ Over the phone, ☐ Web / video conferencing
☐ 1 meeting per month
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Project Approval – for use by ECpE Senior Design Committee

☑ Approved: sddec18-proj041
☐ Project Assigned:
☐ Advisor(s) Assigned:
Client/Company/Organization: ISU Horticulture Department

Submitter Name: Manimaran Govindarasu Email: gmani@iastate.edu

Manimaran Govindarasu (ECP), Ajay Nair (Horticulture) Email: gmani@iastate.edu

Project Title: An IoT-based Irrigation Monitoring Application - Phase II

Project Abstract:
This project, the Lovely Irrigation Monitoring Application (LIMA), focused on the development of a low cost, easy-to-use, wireless monitoring system that guarantees soil moisture accuracy. The goal of LIMA is to ensure farmers are equipped with easily-accessible reliable data (via a smartphone app) to help them determine their exact irrigation needs. The Phase 1 project ended in Fall 2017 in which the team has successfully prototyped and demonstrated the working of the end-to-end system (sensor-to-network-to-app). In Phase 2 of the project, the goal is to optimize the system to improve the accuracy of sensors, energy consumption of sensor network, user-friendliness of the mobile app, and robust field testing of the whole system both in ISU Greenhouse and ISU Research Farms. Since it's a Phase 2 project, most of the time will be spent on refining the design and implementation, and extensive testing and validation comparing with commercially-off-the-shelf products. The project involves embedded system design and mobile application development.

Phase 1 project website: http://dec1717.sd.ece.iastate.edu/

Expected Deliverables:
Sensors, sensor network, mobile app, test results, project plan, system design document, final project report, and poster.

Specialized Resources Provided by Client:
All necessary resources will be provided by the client.

Financial Resources Provided by Client: Sensors, embedded controllers, access to greenhouse and research farm

Anticipated Cost: 

Preferred Students for the Project:
☑ Electrical Engineering
☑ Computer Engineering
☑ Software Engineering
☐ Other:

Other Special Skills: Microcontroller-based circuit design, Embedded software design, mobile app development

Anticipated Client Interaction (estimate):
☑ 1 meeting per week
Meeting ABET Criteria

Please rate the following statements as they relate to your proposed project:

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Project Approval – for use by ECpE Senior Design Committee

☑ Approved:  sddec18-proj042
☐ Project Assigned:  
☐ Advisor(s) Assigned:  
Client/Company/Organization: Iowa State University

Submitter Name: Venkataramana Ajjarapu  
Email: vajjarap@iastate.edu

Project Title: Design and Implementation of a small scale stand alone Hybrid Solar PV and Wind Energy Generation system

Project Abstract:

Renewable energy is getting a lot of attention due to scarcity and bad environmental impact of conventional sources of energy. Wind and solar PV energy are two leading sources of clean energy. Goal of the project is to design and develop a standalone hybrid renewable energy generation system which will consist of wind and solar PV energy. The project will be divided into two parts i.e. software simulation and hardware implementation. For simulations, Simulink-MATLAB will be used following modeling and design aspect will be included:

1. Design and modeling of solar PV panel and maximum power point tracking (MPPT) algorithm using electronic converters.
2. Design and modeling of voltage inverter and its switching mechanism to convert solar DC power to AC.
3. Wind energy generation system
4. Loads, battery bank and their integration to the energy generation system.
5. Integration of Solar PV and wind energy generation system and maintaining power quality of power supply.

After simulation results, a prototype hardware system will be designed and developed in the laboratory. Following aspects will be there in hardware design:

1. Solar panels, voltage inverter and batteries are available. MPPT and other control techniques will be implemented through D-Space real time controller.
2. Wind sensors are available in the lab to measure wind speed and imitate wind turbine o generate energy.
3. Finally, Solar PV and wind will be combined with load and battery bank.

Expected Deliverables:

1.) A real-time demonstration of solar energy generation system; 2.) An experiment design for EE452 lab course

Specialized Resources Provided by Client:

Solar panels, Inverter, batteries, wind sensors

Anticipated Cost:  
Financial Resources Provided by Client: none

Preferred Students for the Project:

☑ Electrical Engineering
☑ Computer Engineering
☐ Software Engineering
☐ Other:

Other Special Skills: matlab, some hardware design, power systems
Senior Design Project Proposal Form

Anticipated Client Interaction (estimate):

☑ 1 meeting per week
   ☑ In person, ☐ Over the phone, ☐ Web / video conferencing
☐ 1 meeting per month
   ☐ In person, ☐ Over the phone, ☐ Web / video conferencing
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Meeting ABET Criteria

Please rate the following statements as they relate to your proposed project:

0 – Not at all 1 – A Little 2 – Somewhat 3 – A Lot 4 – Completely

On this project, students will need to apply knowledge of mathematics, science, and engineering

☐ 0 ☐ 1 ☐ 2 ☑ 3 ☐ 4

This project gives students an opportunity to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

☐ 0 ☐ 1 ☐ 2 ☑ 3 ☐ 4

This project involves students from a variety of programs, i.e., CprE, EE, and SE

☐ 0 ☐ 1 ☑ 2 ☐ 3 ☐ 4

This project requires students to identify, formulate, and solve engineering problems

☐ 0 ☐ 1 ☐ 2 ☑ 3 ☐ 4

This project gives students an opportunity to use the techniques, skills, and modern engineering tools necessary for engineering practice

☐ 0 ☐ 1 ☐ 2 ☑ 3 ☐ 4

Project Approval – for use by ECpE Senior Design Committee

☑ Approved: sddec18-proj043

☐ Project Assigned: ________________________________

☐ Advisor(s) Assigned: ________________________________