Client/Company/Organization:  ECPE

Submitter Name:  Leland Harker  Email:  leharker@iastate.edu
Project Contact:  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
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>2 – Somewhat</th>
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Project Approval – for use by ECpE Senior Design Committee

☑ Approved:  

☐ Project Assigned:  

☐ Advisor(s) Assigned:  

sdmay18-proj001
Client/Company/Organization: ECPE

Submitter Name: Leland Harker Email: leharker@iastate.edu

Project Contact: Leland Harker Email: leharker@iastate.edu

Project Title: Small Equipment Checkout System

Project Abstract:

Students often are working on a project and they need to checkout an Arduino, a breadboard, a tool or other small item kept in the ETG electronic shop. A checkout system will be implemented to hold these small items in a group apartment style mailbox. The student would swipe their ID card and then select the box with the item they want to borrow. The controller will include an informative display showing the status of the items available. If the student is in good standing and the item is available, the respective box would be unlocked and a record would be created showing the borrower’s information. When the checkout period has expired, the item would be returned to the box. There would be multiple copies of each common item. The controller for the boxes would have a network interface to allow for administrative functionality.

Expected Deliverables:

At the end of the project there should be one main control unit and at least 3 box-door lock units completed. There should also be complete documentation to allow expansion for all the boxes.

Specialized Resources Provided by Client:

The ETG staff will be available to assist with the mechanical implementation.

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

Preferred Students for the Project:

☑ Electrical Engineering  ☑ Computer Engineering
☑ Software Engineering  Other Special Skills: At least one member of the team should have mechanical aptitude or experience.
☐ 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

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Project Approval – for use by ECpE Senior Design Committee

☑ Approved: sdmay18-proj002
☐ Project Assigned: 
☐ Advisor(s) Assigned: 


Client/Company/Organization: E.S.A.R.C. L.L.C.

Submitter Name: Bhimesh S. Chauhan  Email: bhimeshchauhan@gmail.com

Project Contact: Deeksha Juneja  Email: juneja.deeksha@gmail.com

Project Title: Augmented Reality Mechanical Design Solution

Project Abstract:

The visualization of an idea is of paramount importance not only in day-to-day life to process information but also in the world of mechanical design. Therefore, we intend to take a step further to help mechanical designers design their product ideas in the three dimensional canvas of Augmented Reality. The scope of the project is to create a software that would help designers design the software with help of Augmented Reality headsets and interact with the design as if it was a prototype.

Expected Deliverables:

Throughout the project we will have following goals to accomplish:
1. Design a UI/UX for Oculus rift to optimally use tools for design process including toolbar, options, tools, view and on screen toolbar with basic shapes.
2. Create a graphic mesh to make a virtual frame of reference overlaying the visible UI canvas.
3. Design an architecture to create the physical models using the knowledge of Algorithms, Data Structures and Graphic Design addressing the edge cases like design appending and deleting.
4. Test the application interactivity with the inputs received from the gestures.
5. Create a set of options to import and export a design to and from other applications like Solidworks, ProE, Creo, and AutoDesk.

Design Constraints:
The software is not expected to do the advanced analysis. The application is limited to designing in 3D space, augmentation of designs by superposition, and import/export of designs.

Tools: OpenGL, OpenCV and Oculus Rift.

Specialized Resources Provided by Client:

Anticipated Cost:  Financial Resources Provided by Client:

Preferred Students for the Project:

☐ Electrical Engineering  Other Special Skills: C++, Python. OpenCV and OpenGL

☑ Computer Engineering

☑ Software Engineering

☐ Other:
Anticipated Client Interaction (estimate):

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

- [x] Approved:  
  sdmay18-proj003

☐ Project Assigned:  

☐ Advisor(s) Assigned:  

Client/Company/Organization: Smart Ag

Submitter Name: Mark Barglof Email: mbarglof@smart-ag.com

Project Contact: Email:

Project Title: Use of imaging devices and machine learning software to assist in autonomous vehicle path planning

Project Abstract: Program overarching goal: Develop a software/electronics system using imaging devices to assist in the path planning of an agricultural vehicle.

The following are the specific objectives:
1) Use of imaging systems to detect field boundaries such as fences, waterways, or terraces
2) Imaging system assists the path planning software to drive along the field boundary ensuring the vehicle does not enter the ditch, hit an obstacle on the boundary (such as telephone poles) or roll into the ditch/terrace.

Technical approaches: Smart Ag current has path planning, imaging and detection software. The project team may suggest the type of imaging device and mounting location best suited to this project, if the team determines other electronics components beyond imaging devices that will be beneficial they may choose to include them as well.

Design constraints: Project team must provide a system that is commercially feasible for agricultural uses. Size - must fit within the cab of a late model tractor and not prevent manual driving, Weight - no constraint, Power - must be powered by the tractor electrical system, Cost - camera/sensor and harnessing must be less than $1000.

Expected Deliverables:
Software and hardware system must be complete by the end of the Spring 2018 semester

Specialized Resources Provided by Client:
SmartAg GPU/CPU embedded device for image processing, image processing software, camera systems

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):

- [x] 1 meeting per week
  - [x] In person, [ ] Over the phone, [ ] Web / video conferencing
- [ ] 1 meeting per month
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- [ ] 2 or more meetings per month
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Meeting ABET Criteria

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☐ 0 ☐ 1 ☐ 2 ☐ 3 [x] 4

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

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

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

Project Approval – for use by ECpE Senior Design Committee

- [x] Approved:  
  
sdmay18-proj004

- [ ] Project Assigned:  
  

- [ ] Advisor(s) Assigned:  
  


Client/Company/Organization:  James Lathrop
Submitter Name: Robert Quinn (student proposed project)  Email: rmquinn@iastate.edu
Project Contact:  James Lathrop  Email: jil@iastate.edu

Project Title:
Animal Locomotion and Behavior Simulated by Genetic Algorithms

Project Abstract:
The project simulates animals with coordinated muscle movements (walk, run, turn, climb, etc.) and behaviors (flock, eat, sleep, evade, etc.) which are both learned from genetic algorithms and driven by needs-based decisions. Animals have realistic 3D physicality, muscle-based motion, and can adapt to various environments. The simulation runs as an application made with Unity, C#, and NVIDIA PhysX. Data about the genome and a preview of the simulation is uploaded to a database and can be viewed online to see trends and comparisons between different generations, animals, and environments. Genomes from the database can be opened and simulated further. The website and server use Angular, MySQL, AJAX, and Highcharts (subject to change). There will be a minimum of 3 unique animals (such as dog, snake, bird). The database will be able to hold the best genome and history of at least 500 generations.

Expected Deliverables:
Design document - October;
Prototype with some genetic algorithm and website running - December;
Core functionality done - February;
Completed application and website - May;

Specialized Resources Provided by Client:
Webserver and Database from Engineering or CS department

Anticipated Cost:  Financial Resources Provided by Client: Pearson

Preferred Students for the Project:
☐ Electrical Engineering  Other Special Skills: Back end web, full stack web, databases.
☐ Computer Engineering
☑ Software Engineering
☑ Other: CprE if strong software back end focus

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

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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, and modern engineering tools necessary for engineering practice | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☑ 4 |

Project Approval – for use by ECpE Senior Design Committee

☑ Approved:  

sdmay18-proj005

☐ Project Assigned: 

☐ Advisor(s) Assigned: 

__________________________________________________________
Client/Company/Organization:  ADINO Lab

Submitter Name:  Timothy A Bigelow  Email:  bigelow@iastate.edu

Project Contact:  Timothy A Bigelow  Email:  bigelow@iastate.edu

Project Title:

3D Metal Printer

Project Abstract:

The goal is to develop a 3D metal printer based on laser sintering. The system will consist of the design of a stepper motor control system to manipulate the powder as well as code to control the lasers needed in the system. The system will have 3 lasers. One to melt the powder, and two to monitor the build process. The system will need to be placed in an environmentally controlled box. Experience or interest in computer programming and lasers/electromagnetics is needed.

Expected Deliverables:

Working 3D printer that is computer controlled.

Specialized Resources Provided by Client:

Lasers, environmental box, stepper motors.

Anticipated Cost:  Financial Resources Provided by Client:  ~$60k

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
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- [☐] 1 meeting per semester
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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

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

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

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

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

☑ Approved: sdmay18-proj006

☐ Project Assigned: 

☐ Advisor(s) Assigned: 
Client/Company/Organization: Black & Veatch

Submitter Name: Adam Literski Email: literskiam@bv.com
Project Contact: Cole Beaulieu Email: BeaulieuCA@bv.com

Project Title: 138kV / 13.8kV Substation Design Project

Project Abstract:
Due to an increased energy demand from a new factory, a 138kV/13.8kV distribution substation will need to be designed by Black & Veatch. The project team will be responsible for the complete design of the substation which includes protection and control design, and associated construction deliverables. Examples of these deliverables include equipment sizing calculations, substation layout drawings, station power design, protection and control schematics, project schedules, etc.

It should be noted that the senior design team assigned to this project will have slightly modified first semester deliverables compared to other senior design projects. The first deliverable will be to develop an engineering man-hour budget and schedule for this project in order to plan the overall senior design project. Black & Veatch will work with the senior design team to manage the scope of the project to allow completion during the Fall and Spring semesters.

Black & Veatch will provide conceptual design information and design standards as identified on the attached project description to support the senior design team's work.

Expected Deliverables:
Refer to "Senior Design Team Deliverables" on the attached Project Description.

Specialized Resources Provided by Client:
Black & Veatch will provide engineering support to help the senior design team complete the project.

Anticipated Cost: Financial Resources Provided by Client: 100

Preferred Students for the Project:
- Electrical Engineering
- Other Special Skills: A team of 3-4 electrical engineering students with courses in power systems is preferred. EE 455, 456, 457, and 458 would be helpful, but not required. AutoCAD knowledge for drafting deliverables would also be helpful.

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

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Project Approval – for use by ECpE Senior Design Committee

☑ Approved: sdmay18-proj007

☐ Project Assigned:

☐ Advisor(s) Assigned:
Client/Company/Organization: InfraDrone.LLC.

Submitter Name: Akash Vidyadharan Email: akash@infradronellc.com

Project Contact: Samuel Eue Email: samuel@infradronellc.com

Project Title: InfraDrone UAS Data Display VR Portal Android Application

Project Abstract:

Design, build & test an Android phone / tablet application capable of displaying data collected from drones such images, engineering reports and 3D models stored in the Amazon Web services (AWS) S3. The application should be able to work on mobile VR devices such as Google cardboard and other similar viewers.

The 3 primary functions of this application are:
1) 3D Visualizer to display models (wavefront .OBJ format)
2) Report Viewer to display engineering reports (.PDF)
3) Image Gallery to display images both original and post processed images (.jpg).

There will be two primary phases and a bonus phase to this project:
Phase 1: Create the Android application to work on non VR mobile environments
Phase 2: Optimize and port to VR starting with the 3D object viewer
Phase 2+: Fully navigable mobile application in both VR and hand-held configuration displaying all data available

Expected Deliverables:

Phase 1: Fully functional Android application capable of displaying all content with the functionality as InfraDrone's web-based portal
Phase 2: VR visualizer with navigation for viewing 3D objects using Android phone

Specialized Resources Provided by Client:

Weekly skype meetings and consulting from InfraDrone's software engineers and data analysts
VR viewer and other extra required hardware

Anticipated Cost: Financial Resources Provided by Client: 100

Preferred Students for the Project:

☐ Electrical Engineering
☐ Computer Engineering
☐ Software Engineering
☐ Other: Other Special Skills: Android App Development Mobile VR software systems

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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</tr>
</tbody>
</table>

Project Approval – for use by ECpE Senior Design Committee

☑ Approved: sdmay18-proj008

☐ Project Assigned: ____________________________

☐ Advisor(s) Assigned: ____________________________
Project Title:

VR UI Design for Engineering Applications

Project Abstract:

Virtual Reality (VR) holds great potential to provide intuitive human-computer interaction capabilities. However, when designing an UI to perform complicated engineering tasks in a VR environment, some traditional desktop interaction paradigms, such as typing characters, entering numbers and precision mouse cursor selection on a complicated UI dialog, become cumbersome, unintuitive or even difficult to perform in a VR environment. The challenges to design VR UI become:

1. Design standard for VR UI – The desktop UI design standard, such as left mouse button for selection and right mouse button for bringing up context menu, is not applicable to the VR UI design.
2. Variety of VR input devices – Due to the variety of VR input devices, such as one or two hand controllers, multiple buttons on the controller, eye gaze selection, voice inputs … etc., the UI experience by using one VR device could not be transferred into another system using different VR devices.
3. Limited screen resolutions - Due to the resolution issue and the difficulty of precision selection in VR environment, the VR UI design cannot be too complicated as designing the desktop UI dialogs.

The goal of this project is to develop a UI that can perform complicated engineering tasks in a VR environment. The UI needs to be intuitive to use and can easily be interacted through various VR input devices (hand/finger tracking devices, mobile phones, sound input, and etc.). It also needs to handle complicated engineering tasks/processes in a VR environment. Students can use the "Path Planning" or "Measurement" feature in Siemens Teamcenter Visualization as an example to simulate the UI interaction process in a VR environment.

Design constraints:
• The UI needs to be rendered on screen (along with the 3D scene).
• The UI can be interacted by various VR input devices in a VR environment as well as on a desktop or a tablet environment.
• The UI needs to allow users to perform multiple tasks.

Technical Approach:
Students can use Unity or other graphics APIs to develop the UI. VR devices (like HTC Vive or Oculus Rift) are not required but preferred. If no VR/AR hardware is available during development, students may use keyboard and mouse to control an "on-screen controller" to interact with the UI.

Tools:
Unity, OpenGL or other graphics APIs.

Expected Deliverables:
• Literature reviews of current research papers and patents on VR UI designs.
• Unity, OpenGL or other graphics API programs to demonstrate the VR UI design and use the UI to perform multiple engineering tasks.
• A desktop application with traditional desktop UI to perform similar engineering tasks for benchmark comparison.
• A user study to evaluate whether a VR UI can be more intuitive to use than a traditional desktop UI when performing complicated engineering tasks

**Specialized Resources Provided by Client:**

Siemens Teamcenter Visualization

**Anticipated Cost:** __________________________  
**Financial Resources Provided by Client:** __________________________

**Preferred Students for the Project:**

- ✔ Electrical Engineering
- ✔ Computer Engineering
- ✔ Software Engineering
- □ Other: ________________

**Other Special Skills:** Unity and C# or OpenGL and C++

**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

☐ 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

☐ 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:  sdmay18-proj009

☐ Project Assigned:  

☐ Advisor(s) Assigned:  

___________________________________________________________________________
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:

- [x] Electrical Engineering
- [x] 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:
**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

---

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

- ✔️ Approved:  
  sdmay18-proj010

- ☐ Project Assigned:  
  

- ☐ Advisor(s) Assigned:  
  

Project Title:
Radio Frequency Readout Device (RFRD) - Phase II

Project Abstract:
The goal of this project is to design and implement an RFID-like battery-free wireless sensing and data collection system, called RFRD (Radio Frequency Readout Device). It consists of an RFRD tag and an RFRD reader.

1) RFRD tag: It shall work similarly to a radio frequency identification (RFID) tag and shall have a similar size as an RFID tag. Different from an RFID tag, the RFRD tag is connected to a capacitor sensor. It works as follows. Firstly, it shall have an energy harvesting component to harvest energy from RF signals generated by a nearby RFRD reader. Then, the harvested energy shall be able to power a special IC on the RFRD tag to measure the (changing) capacitance of the sensor. Finally, based on the sensor reading, it shall generate/modulate a corresponding RF signal, which is received and interpreted by the RFRD reader.

2) RFRD reader: It shall be able to power the RFRD tag wirelessly, receive the sensor reading collected by the RFRD tag, and then report to a smartphone/laptop for data management and display.

This is Phase II of the project. Phase I can be accessed here: http://may1718.sd.ece.iastate.edu/. The goal of Phase II is to improve/revise the previous design 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:

Anticipated Cost: ___________________________ Financial Resources Provided by Client: ___________________________

Preferred Students for the Project:

- Electrical Engineering
- Computer Engineering
- Other: 

Other Special Skills: Prefer to have 3~4 E E students and 1~2 Cpr E students with the following skills:
Circuit Design and Fabrication
Antenna Design
Embedded Systems
Network Programming
Smartphone App Development

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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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:  

sdmay18-proj011

☐ 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.

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

Anticipated Cost:  

Financial Resources Provided by Client:  

Preferred Students for the Project:

☐ Electrical Engineering  
☑ Computer Engineering  

Other Special Skills:
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**

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On this project, students will need to apply knowledge of mathematics, science, and engineering
☐ 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
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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:  sdmay18-proj012

☐ Project Assigned:  

☐ Advisor(s) Assigned:  

______________________________________________

______________________________________________
Client/Company/Organization: Knowledge-Centric Software Lab and EnSoft Corp.

Submitter Name: Suresh (Suraj) Kothari Email: kothari@iastate.edu

Project Contact: Email: 

Project Title: Tool Support for Continuous Model-Based Verification of the Linux Kernel

Project Abstract:

Iowa State University’s Knowledge Centric Software Lab (KCSL) is seeking to
1) automate the process of running its Model Based Verification (MBV) toolbox on new versions of Linux as they become available to produce verification evidence,
2) create a public website to host the verification evidence and facilitate collaboration for the verification process.

Dropbox link to detailed description:
https://www.dropbox.com/s/o13usrj3uban2vg/Model%20Based%20Verification%20MBV%20Toolbox%20Senior%20Design%20Project.docx?dl=0

If the above link doesn’t work contact: kothari@iastate.edu

Expected Deliverables:

1. Automated support for running the MBV toolbox on new versions of Linux.
2. A public website to host the verification evidence and facilitate collaboration for the verification process.

Specialized Resources Provided by Client:

The MBV toolbox. Online documentation and tutorials for the MBV toolbox. Use cases and samples of verification results.

Anticipated Cost: Financial Resources Provided by Client: NA

Preferred Students for the Project:

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

Other Special Skills: A good knowledge and programming experience in Java. Basic knowledge of C.

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
Meeting ABET Criteria

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Project Approval – for use by ECpE Senior Design Committee

☑ Approved: sdmay18-proj013

dmay18-proj013

☐ Project Assigned:

☐ Advisor(s) Assigned:

________________________________________

________________________________________
Client/Company/Organization: ISU ECpE Department

Submitter Name: Long Que Email: lque@iastate.edu
Project Contact: Long Que Email: lque@iastate.edu

Project Title:
Patch-clamp microchip testing circuit interface

Project Abstract:
One of the main techniques to monitor the behaviors of cells is patch-clamp technique. This project aims to setup the patch-clamp testing circuit interface for the patch-clamp microchip. By working with graduate students, it will require the following efforts:

1) Setup the patch-clamp testing circuit interface using the commercial amplifier and probes.

2) Measure the ion channel potential of cells using the patch-clamp microchip.

3) Measure the action potential of cells under external stimulations using the patch-clamp microchip.

The goal of this project is to establish an electrical testing module suitable for patch-clamp chip.

Expected Deliverables:
Complete the electrical testing setup in Fall semester; and carry out the measurement and submit a comprehensive final report by April 2018.

Specialized Resources Provided by Client:
Ag/AgCl electrical probe, etc

Anticipated Cost: Financial Resources Provided by Client: 200

Preferred Students for the Project:

- Electrical Engineering
- Computer Engineering
- Other Special Skills: Circuit design and implementation
- Other: Electrical measurement and real-time data acquisition
- Other: Some knowledge of MEMS

Anticipated Client Interaction (estimate):

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

☐ 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:       sdmay18-proj014

☐ Project Assigned:

☐ Advisor(s) Assigned:

------------------------------
Client/Company/Organization:  John Deere

Submitter Name:  Bailey Akers  Email:  bakers@iastate.edu

Project Contact:  Rick Weires (temporary contact)  Email:  weiresrickl@johndeere.com

Project Title:  Truck to Ag Implement Lighting System

Project Abstract:

The concept we are developing is a lighting converter that will interface a SUV/Truck 7-pin trailer connector to the standard 7-pin connector of an Ag Implement. The goal is to be able to use an SUV/Truck to pull a piece of Ag equipment, such as a baler, down the highway with complete lighting accessibility. This progresses the idea of customers safely and legally pulling John Deere equipment behind a Truck/SUV. This goal is interfacing the SUV/Truck lighting to a John Deere Ag Implement lighting. The design will be to fit the logic in accordance with a provided truth table for industry standard lighting in towed Ag Implements (Rick Weires). Bailey Akers, a past intern at John Deere, is an EE student at ISU. Bailey will be involved in this project. Bailey was able to build a basic design that demonstrates how to interface the lights on a Truck/SUV with the Ag implement. His design needs further development with circuit functionality, user accessibility, and cost effectiveness. John Deere will supply a mentor that is an experienced engineer with embedded system design experience. John Deere will also supply funding.

Expected Deliverables:

Our goals to further the project include: incorporating a digital signal processor (DSP) to act as the microcontroller rather than a Raspberry Pi (which was incorporated in the basic design by Bailey Akers), demonstrating homologation with lighting schemes for towed ag equipment according to the appropriate engineering standards, adding a ground speed sensor to implement different lighting logic schemes at different speeds as well as optimization and development of the software logic for these lighting configurations, creating a hard package to enclose the circuitry to ensure reliability and demonstrate usability with normal wear and tear, and cost optimization for customers to be able to purchase this product and for John Deere to be able to manufacture this product.

Specialized Resources Provided by Client:

Waiting on further details.

Anticipated Cost:  John Deere will provide funding.

Financial Resources Provided by Client:

Preferred Students for the Project:

- Electrical Engineering
- Computer Engineering
- Other Special Skills: C/C++ Programming, hardware design
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

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:  

sdmay18-proj015

☐ Project Assigned:  

__________________________________

☐ Advisor(s) Assigned:  

__________________________________

__________________________________
Client/Company/Organization: Rockwell Collins

Submitter Name: JR Spidell  Email: Clyde.spidell@rockwellcollins.com
Project Contact: JR Spidell  Email: clyde.spidell@rockwellcollins.com

Project Title:
  Pilot Biometrics - ECG waveform captures

Project Abstract:
The goal is to create HW and SW that can be used to detect various stress levels of aircraft pilots. Sensors will be used to capture the pilot’s heart beat waveform. The raw data from those sensors will be captured and an algorithm will be created to detect various stress levels of that pilot.

The filter design, circuit design, ADC unix driver, and algorithm all have to work together to create a complete solution. If a mechanical designer is available, a wearable sensor harness could be developed.

Expected Deliverables:
Objectives:
  An analog filter design specific for heart beat waveforms
  A PCB design with the analog filter + ADS1298 sensor
  A unix OS environment for an ARM M7 processor
  A unix device driver for the ADS1298 sensor
  Software to capture the raw sensor data
  An Octave environment for manipulating the raw sensor data
  An Octave formula to detect various states of the pilot (various levels of stress)
  Mechanical design of wearable sensors

Specialized Resources Provided by Client:
  RC provided:
  STM32F767 eval board (ARM M7 processor)
  ADS1298RECGFE-PDK eval board
  EEG sensors

Funds to create and populate 2 prototype analog sensor 4 layer circuit cards

Anticipated Cost:  

Financial Resources Provided by Client:  

Preferred Students for the Project:
- Electrical Engineering
- Computer Engineering
- Software Engineering
- Other: mechanical engineering

Other Special Skills: Analog filter design, Unix SW development.
Octave tool knowledge.
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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Project Approval – for use by ECpE Senior Design Committee

☑ Approved: sdmay18-proj016

☐ Project Assigned:

☐ Advisor(s) Assigned:
Client/Company/Organization: Grace Engineered Products

Submitter Name: Bryan Van Itallie Email: bryanvi@grace-eng.com

Project Contact: Mark Hockert Email: mhockert@grace-eng.com

Project Title: Measuring Voltage and Wire Continuity

Project Abstract:
Develop a device that can measure the voltage in a 3-phase system (up to 600 V):
- The device would be permanently mounted in an electrical cabinet
- The device would be able to determine that the wires connected to the test points are not broken (this is the main challenge to overcome)
- The device would report the presence or absence of voltage (down to 3V minimum) as well as the health of the wires
- The device would be able to provide indication locally as well as communicate via Ethernet/IP

Expected Deliverables:
Develop a concept solution during the fall semester.
Design and test a prototype device during the spring semester.

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):
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Meeting ABET Criteria

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Project Approval – for use by ECpE Senior Design Committee

☑ Approved: sdmay18-proj017

☐ Project Assigned: 

☐ Advisor(s) Assigned: 

________________________________________

________________________________________
Client/Company/Organization: Iowa State University, Department of Civil Engineering

Submitter Name: Prof. Mani Mina
Email: mmina@iastate.edu
Prof. Mani Mina, Neelam
Project Contact: Prabhu Gaunkar
Email: neelampg@iastate.edu

Project Title:
Reorientation of magnetic nanoparticles in soil using controlled variations of magnetic fields

Project Abstract:
This project focuses on designing a system that can deliver certain magnetic fields for applications in biomedical and other bioscience, and solid science applications. The immediate applications of variable magnetic fields will be used to control orientation of magnetic nanoparticles embedded in soil for improved mechanical strength and application to sustainable infrastructure.

Project goals:
Over a duration of two semesters the team will work towards identifying magnitude of magnetic field suitable for nanoparticle reorientation, design and fabricate an electronic/magnetic circuit that can deliver the expected magnetic field.

Semester 1:
- Trials with a dc permanent magnet for estimation of magnetic field required for reorientation of magnetic particles.
- Provide design approach with proof of concept prototype of circuit that can generate required magnetic field for particle reorientation.

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

Design Specifications:
Estimated magnetic flux density: 100 – 500 Gauss
Pulse Width: 100 microseconds or more
User friendly control of magnetic pulse generation

Expected Deliverables:
- Semester 1: Estimation of required field for particle reorientation, design of proof of concept prototype
- Semester 2: Working device with adequate control from user

Specialized Resources Provided by Client:
The client will provide samples containing magnetic nanoparticles or liquid soil for testing purposes.
### Anticipated Cost: ________________________  Financial Resources Provided by Client: ________________________

**Preferred Students for the Project:**
- Electrical Engineering
- Computer Engineering
- Software Engineering
- Other: EE students with some experience in
- ☑ power

**Other Special Skills:** Students with good understanding of circuit simulation tools such as PSpice and interest in measurements would be the best fit.

### 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
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### Meeting ABET Criteria

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### Project Approval – for use by ECP E Senior Design Committee

- ☑ Approved: sdmay18-proj018
- ☐ 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
- Other Engineering
- Other: Students who have experience in power, circuits, EM, measurements
- Other Special Skills: Students with experience in circuit simulation tools such as PSpice and interest in measurements would benefit from this project.

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
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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: sdmay18-proj019
- Project Assigned: 
Client/Company/Organization: Genova Technologies

Submitter Name: Dawn Ainger Email: dawn.ainger@genovatech.com

Project Contact: Austin Mouw Email: austin.mouw@genovatech.com

Project Title: Mobile and Web Timecard

Project Abstract:
Mobile and Web Timecard (MWT) will involve creating a mobile and web version of a timecard application for Genova Technologies. It will involve:
* Creating a mobile version of a timecard
* Creating a web version of a timecard (if time allows)
* Storing and retrieving data from/to a database server on Amazon Web Services
* Using industry standard software development tools
* Use the Agile methodology tool, Rally, to complete the project.

Project Manager, Austin Mouw, will be on-site at ISU many days during the semester to answer any questions. Genova Technologies is a software engineering company based in Cedar Rapids, Iowa. For more information about Genova, visit www.genovatech.com

Expected Deliverables:
Mobile Version of Timecard
Web Version of Timecard (if time permits)

Specialized Resources Provided by Client:
Austin Mouw, Project Manager
Dawn Ainger, CEO
Tom Sidebottom, Mobile and Web Development Specialist

Anticipated Cost: Financial Resources Provided by Client: 20000

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
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### Meeting ABET Criteria

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

☑ Approved: sdmay18-proj020

☐ Project Assigned: 

☐ Advisor(s) Assigned: 

______________________________

______________________________

______________________________
Client/Company/Organization: Critical Labs

Submitter Name: Taylor Greiner  Email: taylor@criticallabs.io

Project Contact:  Email: 

Project Title: InfrastructureAR (Augmented Reality Infrastructure Analytics App)

Project Abstract:
Technology is advancing at a rapid pace, and Critical Labs is at the forefront of modernizing critical infrastructure. If you have ever walked through a data center, you know that it is a large room with neutral colors and blinking lights. Understanding how equipment is performing is time intensive and difficult, requiring a technician to either go back to their desk or lug around a laptop. Critical Labs is looking to change this. Students will develop an iOS application that takes advantage of augmented reality to overlay data from Critical Labs InfrastructureAR application on top of real physical equipment out in the field. Students will use computer vision to analyze camera inputs to identify equipment and display correlating information on the screen. Ideally, the iOS application will allow a data center technician to walk up to a piece of equipment, hold up their phone, and display relevant information overlaying the camera image in real time.

Expected Deliverables:
An iOS application that can display graphs and data overlaying a live camera image of a computer room air conditioner (provided by Critical Labs)

Specialized Resources Provided by Client:
iOS device, InfrastructureAR API access

Anticipated Cost:  Financial Resources Provided by Client: 500

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

Other Special Skills: mobile development, JSON web services, experience using REST APIs

Anticipated Client Interaction (estimate):
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☐ 1 meeting per month
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Project Approval – for use by ECpE Senior Design Committee

☑  Approved:  sdmay18-proj021

☐  Project Assigned:

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

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

Project Contact: Vikram Dalal Email: vdalal@iastate.edu

Project Title: Design & 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: most, but $1k from dept.

Preferred Students for the Project:
- Electrical Engineering
- Other Special Skills: EE332; EE432 or 438 preferred

Other:
- Computer Engineering
- Software Engineering
- Other:

Anticipated Client Interaction (estimate):
- 1 meeting per week
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- 2 or more meetings per month
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### This project requires students to identify, formulate, and solve engineering problems

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

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

- ☑ Approved: sdmay18-proj022
- ☐ Project Assigned:
- ☐ Advisor(s) Assigned:
Client/Company/Organization: ISU

Submitter Name: Ian Dobson Email: dobson@iastate.edu

Project Contact: Email: 

Project Title: Design and evaluation of reliability of many similar components by feedback

Project Abstract:
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.

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

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: 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: sdmay18-proj023

☐ Project Assigned: ________________________________

☐ Advisor(s) Assigned: ________________________________

______________________________
High current pulse generator for the application of Transcranial Magnetic Stimulation

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: __________________________
### Anticipated Client Interaction (estimate):

- [x] 1 meeting per week
  - [x] 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, [x] 1, [ ] 2, [ ] 3, [x] 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, [x] 3, [x] 4

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

- [ ] 0, [x] 1, [ ] 2, [ ] 3, [x] 4

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

- [ ] 0, [x] 1, [ ] 2, [ ] 3, [x] 4

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

- [ ] 0, [x] 1, [ ] 2, [ ] 3, [x] 4

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

- [x] Approved: sdmay18-proj024

- [ ] Project Assigned: 

- [ ] Advisor(s) Assigned: 
Client/Company/Organization:  Information Assurance Center (Julie Rursch and Doug Jacobson)

Submitter Name:  Julie Rursch and Doug Jacobson  Email:  jrursch@iastate.edu

Project Contact:  

Project Title:  Building wireless lab space on a college campus

Project Abstract:

Connecting cell phones, tablets, laptops, and desktops to a network is commonly done through wireless access. Many times these connections are not secure and/or can be easily monitored or intercepted. While we can somewhat replicate simple wireless scenarios in a lab for students, it involves a great deal of equipment and the overlap of the wireless channels makes it difficult to setup more than a few wireless access points for students to work with. Further, wireless connections can be accidentally used by unsuspecting innocents as they connect with real world communication and that traffic finds itself on the laboratory wireless network being sniffed.

The proposal is for the creation of wireless facility to be created for graduate coursework in wireless security. This wireless network would require creating a Feraday cage around the wireless equipment such that only those in the labs could connect to it and additionally that it would be secured from the campus network using a proxy server so that undesirable traffic would not escape into the wild.

Expected Deliverables:

Demonstration that the created wireless facility that is created works properly would include the creation of at least two activities students in the wireless course could undertake successfully and not have their traffic be seen or interfere with the campus network. Additionally, the wireless facility would need to be able to be established in a room such as Coover 1041 for lab work.

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

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:  

☐ Project Assigned:  

☐ Advisor(s) Assigned:  

sdmay18-proj025
**Anticipated project**

**Project Title:**

Being able to inventory cattle genetic straws inside the storage container without damaging the product

**Project Abstract:**

In cattle production you have 9 months, the gestation period for a cow, to wait to improve the genetics of your herd. Farmers and ranchers have turned to using artificial insemination to increase the genetic potential in their herds from proven sires. In the cattle industry semen is collected from genetically superior bulls, frozen and stored in a plastic tube called a straw. The straws look like opaque swizzle sticks. These straws have identifying numbers printed on them to record the company, the breed of cattle, the name of the bull, and the date of collection. The straws are then rapidly frozen (similar to cryogenics) and stored in liquid nitrogen at the collection facility. The straws are ordered in units of 5 or 10 by the salesperson. When ordered the straws are sent out in vapor shipper via UPS to the salesperson. The salesperson transfers the straws from the shipper to their own storage tank filled with liquid nitrogen. They continue to store until the time when a farmer or rancher has cows to be bred go into estrus.

Controlling inventory in the local tanks that the salesperson uses (or in some cases the farmer or rancher use) is problematic. Pulling the straws out of the tank to count the inventory is not very easy. The straws cannot be exposed to ambient air temperatures because the warm air damages the product and can cause poor or non-existent conception rates. If an inventory is done, it usually is with a flashlight looking into the neck of the tank and doing a rough count of straws, all the while trying to keep from damaging the straws.

The proposal is for a way to create an RFID or other wireless technology to be printed or attached to these very small straws and then read remotely via a cell phone, tablet, or laptop. Two problems immediately present themselves for this project. Liquid nitrogen is at -346 degrees F in the storage tank. And, the tanks are made of metal which basically make them Faraday cages.

**Expected Deliverables:**

The application that could be used on a cell phone, tablet, or laptop, as well as the technology to read inside the tank wirelessly and print or label each straw for inventory with the appropriate technology.

**Specialized Resources Provided by Client:**

Sample straws with water in them (not semen) and a tank could potentially be provided. The tanks are between $600 and $1200 so will need to be handled with care as the vacuum seal to keep the liquid nitrogen in its cold state cannot be damaged. Liquid nitrogen to fill the tank would need to be sourced locally and students who work on this project need to handle it with appropriate protective gear including gloves and eye glasses. If liquid nitrogen comes in contact with skin or eyes it immediately freezes and the person ends up with a burn like, very serious lesion.

**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:

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

- 0
- 1
- 2
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- 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: sdmay18-proj026
- Project Assigned:
- Advisor(s) Assigned:
Client/Company/Organization:  Julie Rursch and Doug Jacobson

Submitter Name:  Jacobson  Email:  jrursch@iastate.edu

Project Contact:  

Email:  

Project Title:  Implementing OpenPLCs into a Cyber Defense Competition

Project Abstract:

This is an experimental project where seniors will work with OpenPLCs to determine if and how they can be implemented into a Cyber Defense Competition. We believe these may be useful in simulating cyber physical devices, however, it will take some exploration, as well as development time. We would select one or two cyber physical infrastructures for the seniors to evaluate and then design the system to work within the CDC constraints.

Expected Deliverables:

Evaluations of the OpenPLCs and the cyber physical infrastructures to determine which of these are viable for use in a Cyber Physical CDC. Once an area is selected, the system needs to be build and integrated into the CDC delivery system (an ISERink).

Specialized Resources Provided by Client:

Access to an ISERink will be provided to the students.

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
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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: ________________________________

☐ Project Assigned: ________________________________

☐ Advisor(s) Assigned: ________________________________
Client/Company/Organization: Christine M. Shea-Hunt

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

Project Contact: 
Email: 

Project Title: 
Guardian Angel Phone Safe

Project Abstract:

Project Goal: To design and create a two-sided 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.

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.

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 that is placed in Side 2 is, in fact, a cell phone. Likewise, there would should be a means to ensure that the contents placed in Side 1 is, in fact, the key or key fob that corresponds to the user's vehicle. This will ensure that individuals do not place benign objects in the case in order to open access to the cell phone. 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 December 2017

Specialized Resources Provided by Client:

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

Preferred Students for the Project:

- [x] Electrical Engineering
- [x] Computer Engineering
- [x] Software Engineering
- [ ] Other:

Other Special Skills: Computer/software expertise necessary to design a case that is able to recognize the contents such that each side of 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
- [x] 1 meeting per month
  - [ ] In person, [ ] Over the phone, [x] 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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- [x] 4

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- [ ] 0
- [x] 1
- [ ] 2
- [ ] 3
- [x] 4

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

- [ ] 0
- [ ] 1
- [x] 2
- [ ] 3
- [ ] 4

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- [ ] 0
- [ ] 1
- [x] 2
- [ ] 3
- [x] 4

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

- [ ] 0
- [ ] 1
- [x] 2
- [ ] 3
- [ ] 4

Project Approval – for use by ECpE Senior Design Committee

- [x] Approved: sdmay18-proj028
- [ ] Project Assigned:
- [ ] Advisor(s) Assigned:
Client/Company/Organization:  Reiman Gardens

Submitter Name:  Nathan Brockman  Email:  Mantisnb@iastate.edu

Project Title:  Unified Butterfly Recorder 6: Connecting the pieces

Project Abstract:

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.
The above lists are items that were identified by the Reiman Gardens staff but we don’t pretend to know all of the potentials of an application of this sort so we are definitely open to additional suggestions and functionalities.

While UBR is designed for butterfly surveys, it could be a model for other groups that do animal surveys, such as those for other insects, reptiles, birds, and mammals. Upon completion and distribution, UBR and associated elements, are receiving worldwide utilization and may be a model for other biological programs.

I would like the group to utilize an agile software design methodology as they work through the development process with Reiman Gardens’ entomology staff.

UBR May 1708
Nathan, sought suggestions for future work in regards to the UBR effort. Detailed below is the current state of the project as I, Greg Harris, perceive it as well as fleshed out features and improvements that could reasonably be considered Senior Design Projects.

Mobile Application Status Work related to the mobile applications is complete. Multiple different user groups actively engage with the product. The app is advertised and serves its purpose well without crashing. The problems that do arise with both the mobile applications is the lack of documentation. The information generated via the course work does well to explain what the applications do but not how they do them. A massive effort to create documentation for the existing framework would allow for future feature development by senior design groups.

Android Performs as expected, there are no obvious bugs to fix. Picture data is not exported and a server or web application was not built into the design of the App. Documenting how the App currently works is a good first step to designing a method for integrating with the Web application appropriately.

iOS
Poor data management, during the development of May1708’s project the iOS application required several exceptions to the rule as far as our design was concerned. Documentation would be incredible for working with this app. The iOS UBR application is coded in swift and still contains a bit of parse. It is not organized in such a way that you can easily understand what sections of do what. Think model view controller shema. iOS was designed with a web application in mind but until documentation is done it will be difficult to derive the appropriate way to integrate the web application. For example the standard that UBR strove for should have an equal data standard which all applications adhere to. Andriod’s seems to make the most sense. Depending on the link in the chain that the WebApp is integrated these data caveats and considerations may be mitigated.

Web Application Status
Login, Data storage, interface and early charts and early 3rdparty communication have been established. From a “what meat is left” for a SE Design team standpoint, Flutry could use a 3.0 version. Continued development would increase adoption and build from the base of work already completed. Building of previous work is not as sexy as building an application up from the base, but a more realistic work experience. Unless you form your very own company, you will manage another developer's code. Documentation from a what does what standpoint, pretty poor. Luckily I’m still around to document it, or help teams use it, the application is organized in such a way that it is easily navigated(code wise).

Future Work
Improvements
  ● Documentation
I've harped on this quite a bit. What I would like to see is folder structure trees with description of what areas do
what. Design Documents with file names defining what file is meant to accomplish which task (use case). How to run the application, in a dev environment, how to test, how to deploy to production. Documentation will lessen the burden on older teams. Moving forward this level of documentation should be required for future work with UBR.

- **Data Standard**
  Android has a consistent method of denoting information in a CSV file, which is how all of the data is getting passed around currently. This CSV is based off of how either the Database(DB) within the application is arranged or how CSV_Builder(not actual function) operates. I’m not certain how they are printing the DB to CSV. My point either you standardize the way a CSV is printed or you standardized the DB. Example: iOS uses quotes to delimit values, within the generated CSV, users may enter information with quotes within the App, some data comes with additional quotes around it via the generations process. To marshall this data into JSON or Spring Beans (Objects) costs processing power/money. Exceptions are a processing cost and a maintenance cost.

- **3rd Party Integration**
  Needs more work.

**Features**

- **Images**
  Currently you may take pictures within both mobile applications but there is no method of transferring those photos to a web application. If included in the CSV as a BASE64 encoded string the uploads would grow significantly in size. Making a greater argument for a piecemeal upload design. Adding images as feature to upload would require documentation of both the mobile applications and a new upload method. Perhaps leveraging firebase.

- **Image Recognition**
  You can use googleapi’s to do this. Super cool machine learning project here. Train flutr to recognize and identify species of butterfly.

- **Image analysis**
  What other data can we gather from these images? Lighting, foliage, other butterflies.

**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
- [x] Computer Engineering
- [ ] Software Engineering
- [ ] Other:

**Anticipated Client Interaction (estimate):**

- [x] 1 meeting per week
  - [x] 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>
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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:  

sdmay18-proj029

☐ Project Assigned:  

☐ Advisor(s) Assigned:  

_________________________________________  
_________________________________________  

_________________________________________  
_________________________________________
Client/Company/Organization: Nicola Elia & Philip Jones: Iowa State University

Submitter Name: Phillip Jones & Nicola Elia Email: phjones@iastate.edu

Project Contact: Phillip Jones Email: phjones@iastate.edu

Project Title: MicroCart (Microprocessor Controlled Aerial Robotics Team)

Project Abstract:
The main goal of the MicroCART project is to showcase the skill sets our students develop through the ECpE department by helping push the boundaries of battery-powered autonomous flight capabilities within the department. The most visible outcome of the project will be an autonomous UAV system performing a mock high-impact real world application, which will be defined by the team during the initial stages of the project.

This year’s team will:
1. Refine integration of the quadcopter platform into a high-speed camera tracking system.

2. Extend the modular design of the software infrastructure to allow graduate and undergraduate students the ability to test various control and sensor processing algorithms.

3. Develop software, hardware, algorithms, sensor processing, and math models of the quad-copter as needed to support the implementation of the real word application.

4. Design and Implement a mock real world application that is preformed by an autonomous UAV system as a showcase exhibit for the public during tours of the department.

Students will employ knowledge and skills that they have developed throughout their time at ISU and will need to expand their minds to pick up new knowledge and skills. They will make use of a number of design tools such as Matlab, Simulink, FPGA-based hardware design tools, CAD tools for structural design, Graphical User Interface frameworks.

Expected Deliverables:
1) Integration of quadcopter into a high-speed camera system, 2) Extend modular design to enable testing advanced controllers and signal processing, 3) Design and develop of capabilities to support implementation of the real world application, 4) Design and implement a mock real-world demo for visitors

Specialized Resources Provided by Client:
1) Current flight infrastructure (e.g. vehicles and PC for development), 3) FPGA boards for deploying System on chip architectures, 4) 12 camera based high-speed object tracking system.

Anticipated Cost: Financial Resources Provided by Client: $500+opt laptop

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

Other Special Skills: 1)Embedded C programming & Network socket programming
Software Engineering

2) VHDL Hardware design

3) Signal processing (for filtering sensor data)

4) Controls design (Matlab/Simulink)

5) Modeling system dynamics (Matlab/Simulink)

6) System level diagnosis and debugging

7) Hands on building (electronic and mechanical assembly)

8) User Interface development & SW integration

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

Project Approval – for use by ECpE Senior Design Committee

☑ Approved: sdmay18-proj030

☐ Project Assigned: __________________________________________

☐ Advisor(s) Assigned: __________________________________________
Client/Company/Organization: Civil, Construction and Environmental Engineering (CCEE) and Electrical and Computer Engineering (ECpE) at Iowa State University

Halil Ceylan, Professor of CCEE and Mani Mina, Associate

Submitter Name: Professor of ECpE

Email: wsteh@iastate.edu

Project Contact: Wei Shen Theh

Email: wsteh@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: None

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:

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Project Approval – for use by ECpE Senior Design Committee

✔️ Approved: sdmay18-proj031
☐ Project Assigned: ________________________________
☐ Advisor(s) Assigned: ________________________________
Client/Company/Organization: Lotfi ben Othmane

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

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

Project Title: Fleet monitoring system

Project Abstract:
The goal of this project is to develop a system for collecting in-vehicle data of a fleet, archiving them in a remote store, and providing interfaces to monitor the vehicles and to develop statistics that use the data.

Expected Deliverables:
1. A component that collects data from CAN-bus and sends them through a Bluetooth paired mobile phone.
2. A service to accept data and store it in a database.
3. An interface to monitor the state of a given vehicle in terms of speed, position, level of gas, etc.
4. A service that offers API to access the collected data based on given access control.

Specialized Resources Provided by Client:
The vehicle interface 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: 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:
### Senior Design Project Proposal Form

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

- ☑ Approved: sdmay18-proj032
- ☐ Project Assigned: _________________________________
- ☐ Advisor(s) Assigned: _________________________________

____________________________________________________
Client/Company/Organization: Lotfi ben othmane

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

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

Project Title: DevOps for Javascript-based microservices

Project Abstract:
There is a tendency to develop software as a collection of managed micro-services. Often these software are to be deployed to the cloud. The goal of this project is to develop an environment to develop Javascript-based micro-services that exhibit specific quality attributes and automated devOps process for managing the development and deployment of these java-script micro-services.

Expected Deliverables:
1- An automated devOps process for Javascript application (guithub, jenkin, docker, etc.)
2- Framework to develop Javascript-based micro-services that support the major preferred quality attributes such as scalability, security, performance.
3- Interface to monitor the deployed micro-services.

Specialized Resources Provided by Client:
None

Anticipated Cost: __________ Financial Resources Provided by Client: none

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

Other Special Skills: Software architecture, javascript

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>Rating</th>
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</tr>
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<tbody>
<tr>
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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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This project involves students from a variety of programs, i.e., CprE, EE, and SE  
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This project requires students to identify, formulate, and solve engineering problems  
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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:  
sdmay18-proj033

☐ Project Assigned:  

☐ Advisor(s) Assigned:  


Client/Company/Organization:  

Submitter Name: Jaeyoun Kim  
Email: plasmon@iastate.edu  
Project Contact:  
Email:  

Project Title:  
A Disappearing A Pillar  

Project Abstract:  
The A pillars in many cars block or limit the driver's view, causing dangers and accidents. While it is impossible to eliminate the A pillar from cars, it may still be possible to work around it and provide extended viewing angles to the drivers. This project aims to explore the feasibility of making the A pillar "virtually transparent" through the use of the camera, display, and computation capabilities of widely available, inexpensive tablets.

Expected Deliverables:  
1st semester: Planning & Feasibility Studies, 2nd semester: Practical Implementation, Deliver one "virtual window" implemented on an Android Tablet.

Specialized Resources Provided by Client:  

Anticipated Cost:  
Financial Resources Provided by Client:  

An 8~9" android tablet and programming environment  

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

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

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

Project Approval – for use by ECpE Senior Design Committee

☑ Approved:  

☐ Project Assigned:  

☐ Advisor(s) Assigned:  

sdmay18-proj034
Client/Company/Organization: Civil, Construction and Environmental Engineering (CCEE) and Electrical and Computer Engineering (ECpE) at Iowa State University

Submitter Name: Halil Ceylan, Professor of CCEE   Email: hceylan@iastate.edu

Project Contact: Shuo Yang   Email: shuoy@iastate.edu

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

Project Abstract:
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.

Project Goals:
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

Design Specifications:
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

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

Specialized Resources Provided by Client:
Self-made MEMS based temperature and moisture sensors

Anticipated Cost: Financial Resources Provided by Client: None

Preferred Students for the Project:
☐ Electrical Engineering  Other Special Skills: No
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
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Meeting ABET Criteria

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Project Approval – for use by ECpE Senior Design Committee

- [✓] Approved: sdmay18-proj035
- [ ] Project Assigned: 
- [ ] Advisor(s) Assigned: 

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The document is a Senior Design Project Proposal Form from Iowa State University's Department of Electrical and Computer Engineering. It includes sections for selecting disciplines (Computer Engineering, Software Engineering, or Other), anticipated client interaction, meeting ABET criteria, and project approval details.

The form contains a table for rating statements related to the project's educational outcomes. The table ranges from 0 to 4, with 0 representing not at all and 4 representing completely.

The project approval section includes fields for the project approval status, project assignment, and advisor assignments. The proposal is marked as approved with the code sdmay18-proj035.
Client/Company/Organization: Ames Laboratory

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

Project Contact: Email: 

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

Project Abstract:

Develop a visual application to correlate publicly exposed ICS devices (ex ICS Shodan, Censys IO) with 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 Java/Web Server (or equivalent technology) 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 - Java Web Site on internal server resources
Final Paper - Discuss methods and findings from correlation attempts
Documentation - Planning Doc, Requirements/UI Wire Frame, Test Plan/Results, Configuration Index
Semester 1 - Plan, Requirements, Design, Prototyping
Semester 2 - Coding, Testing, Final Demonstration

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:

Other Special Skills:

Anticipated Client Interaction (estimate):

☐ 1 meeting per week
  ☐ 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:

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

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

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

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

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

Project Approval – for use by ECpE Senior Design Committee

☑ Approved: sdmay18-proj036

☐ Project Assigned:

☐ Advisor(s) Assigned:
**Client/Company/Organization:** ECpE dept.; Iowa State University

**Submitter Name:** Goce Trajcevski  
**Email:** gocet25@iastate.edu

**Project Contact:**  
**Email:**

**Project Title:** Smart Laundry Planner

**Project Abstract:**

Often times, washing+drying activities are halted due to washers and/or dryers being occupied at the desired time. While this is not too big of an overhead in houses/apartments with their own washer+dryer units and can be arranged on-the-fly (or pre-planned), whenever a use of a common-area or laundromat (i.e., a facility with much larger-capacity washers/dryers) is required, wasting a trip or having to wait too long can be an overhead.

The aim of this project is to design and implement a smart laundry planner which, globally, will need to have the following basic components:

- **C1:** Sensing unit (e.g., a vibration sensor) that will detect whether a particular device is occupied or available.
- **C2:** Communication unit, which will be able to transmit/convey the status of the particular laundry unit to end-user.
- **C3:** Interface (ideally, an app for mobile devices) that will display the status for end-users.

Ideally, it is desirable to provide following components/functionalities:

- **C1':** Machine learning based solution that will provide a prediction as to when one should plan to do a laundry (for a given load-size);
- **C2':** A module that will use a map-based display and provide information about status of the machines in multiple laundromat-sites.

The main learning objective of the proposed project is for the team(s) to get exposed to the interplay of heterogeneous components (sensing, communication, ML algorithms and prediction) that need to be "fused" in a particular implementation. The main advantage is that the knowledge/skills from this project can be readily generalized to different scenarios. Lastly, the different components require team-members with different expertise, while the project as a whole does require an integration-step.

**Expected Deliverables:**

- **Week#3:** Preliminary Design;
- **Week#4:** Tasks/Roles and Purchase of items
- **Week#7:** Report on individual progress for C1-C3;
- **Week#9:** Working version of a (sub)system integrating C1<->C2 and C2<->C3
- **Week#10:** Design document - first draft
- **Week#11:** Progress report on the overall integration and revised draft
- **Week#12:** Preliminary draft of the poster and design of a testing/demo scenario
- **Week#13:** Final draft of the design document and final/tested version of the demo
- **Week#14:** Final poster-version and final demo-testing; Plans for the added functionality (C1'; ...) to be completed in 492.

**Specialized Resources Provided by Client:**

- sensors; Rapsberry's/Arduino's; mobile(s); server

**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:

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<tr>
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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:  

☐ Project Assigned:  

☐ Advisor(s) Assigned:  
Client/Company/Organization:  Adan Cervantes

Submitter Name:  Adan Cervantes  Email:  ARCervantes@Protonmail.com

Project Contact:  Adan Cervantes  Contact:  ARCervantes@Protonmail.com

Project Title:  Adaptive Wireless Wearable Neuro-Stimulator

Project Abstract:
Design of a wireless Bluetooth wearable ankle device for the purpose of providing programmable pulse simulations determined by bio-metric feedback from the user. The project requires custom software development to interface with available off-the-shelf miniature sensors, such as temperature and motion detection devices. Low power consumption is a must. The goal is to develop the software which uses the sensors bio-metric data as inputs and outputs the pulse stimulus to the user at selected sleep states. A large memory capacity is desired for data collection and further sleep evaluations.

Expected Deliverables:
The final deliverable is the wearable device, software source code, flow chart, and system diagram.

Specialized Resources Provided by Client:
Client can provide access to large storage for data archival, either on Terabyte drives or web server storage.

Anticipated Cost:  Financial Resources Provided by Client:  Client will pay for the needed sensors, prototype circuit cards, and other material associated with the project development.

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

Other Special Skills: Knowledge of Bluetooth communications, programming knowledge and code development. Some internet familiarity for uploading data to web servers.

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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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:  

sdmay18-proj038

☐ 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: 500

Preferred Students for the Project:
☑ Electrical Engineering  Other Special Skills: PCB Layout, Circuit design, Python, SQL
☑ Computer 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:

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Project Approval – for use by ECpE Senior Design Committee

☐ Approved:  

sdmay18-proj039

☐ Project Assigned:  


☐ Advisor(s) Assigned:  


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 attackers 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-existant 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
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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- ☑ 0
- ☐ 1
- ☐ 2
- ☐ 3
- ☑ 4

Project Approval – for use by ECpE Senior Design Committee

- ☑ Approved: sdmay18-proj040
- ☐ Project Assigned: 
- ☐ Advisor(s) Assigned: 
Client/Company/Organization: Henderson Products

Submitter Name: Shane Chesmore Email: schesmore@hendersonproducts.com

Project Contact: James Timmerman Email: jtimmerman@hendersonproducts.com

Project Title: Internet of Things, Data Analytics for Snow Plow Truck-Data Live

Project Abstract:

Henderson develops Class 8 plow and salter trucks that our customers use to clear highways throughout the world. We have developed a low cost data logger that when installed on a truck and paired with various sensors, gathers data from the CANbus network and GPS receiver and transmits the logged data to an internal FTP site via a Verizon cellular gateway. Typical sensors used on a vehicle may include pressure transducers, rotary encoders, linear transducers, and inductive proximity switches. The data logger transmits multiple streams of hexadecimal data to a CSV file that we in turn manipulate and convert to decimal values, thus allowing us to better understand the operating states of the vehicle while being used in a real-world scenario. The data gathered during normal use of the vehicle is critical in providing accurate information to our customers and allowing us to design our products to withstand the harsh environment that they are typically operated in.

For this project, we will up-fit a customer truck in the Ames area so that you as a student can see the vehicle and equipment in action and better understand the significance of the data acquisition. We will provide either access to our FTP site, or a mirrored solution allowing you to access the acquired data in real-time. We have a list of all of the data origination including any addressing or converting of the hexadecimal address and conversion factors required to manipulate the data, and this information will be provided upon project launch.

The objective of this is not to understand the sensors, but to help us develop a set of analytics and database architecture to help our service group predict failures and our customers/operators monitor real time applications for multiple trucks on the roadways through a web based UI during a winter storm event. Some of the data to display will be hydraulic pressures, motor rpm(which relate to application rate), air temp, road temp, gps data for location and speed traveled.

Expected Deliverables:

Developing a set of analytics and database architecture to help our service group predict failures and our customers/operators monitor real time operations for multiple trucks on the roadways through a web based UI.

Specialized Resources Provided by Client:

Datalogger attached to local truck providing data, dedicated team member

Anticipated Cost: Financial Resources Provided by Client:

Preferred Students for the Project:

☐ Electrical Engineering
☑ Computer Engineering
☑ Software Engineering
☐ Other: Other Special Skills: Data analytics and software development for providing visual numerical display
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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On this project, students will need to apply knowledge of mathematics, science, and engineering
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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: sdmay18-proj041

☐ 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:

**Other Special Skills:** 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
Meeting ABET Criteria

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Project Approval – for use by ECpE Senior Design Committee

☑ Approved: sdmay18-proj042

☐ Project Assigned: ________________________________

☐ Advisor(s) Assigned: ________________________________
Client/Company/Organization:  **EE432/532**

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

Project Contact:  **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 (Android 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
- Computer Engineering
- Software Engineering
  - Other: One EE student who is taking (or has taken) EE432 and two SE students

**Other Special Skills:** mobile APP development

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

Meeting ABET Criteria

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

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Project Approval – for use by ECpE Senior Design Committee

☑ Approved: sdmay18-proj043

☐ Project Assigned:

☐ Advisor(s) Assigned:

______________________________________________________________

______________________________________________________________
Client/Company/Organization: Laboratory of Integrated Optical Sensors

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

Project Contact: _______________________________ Email: _______________________________

Project Title: Optical force transducer for visualizing cell mechanotransduction in 3D

Project Abstract:
Mechanical force signaling in cells has been regarded as a foundation of various physiology functions. To understand the nature of these biological and physiology process, the study of the mechanical signal transduction dynamics in live cells is required. The senior design project aims to carry out preliminary study on a fiber-based optical force transducer that can characterize mechanical force transduction in live cells. The team will model and fabricate nanosprings consisting of DNA molecules sandwiched between tapped optical fiber and nanoparticles (quantum dot or gold nanoparticles). We will measure the distance between the nanoparticles and fiber in real time by monitoring the light scattering. A mathematical model will be developed to quantify the force according to the scattering intensity.

Expected Deliverables:
The expected deliverables are listed below:
1. A numerical model to design the optical force transducer
2. Surface chemistry protocols to link nanoparticles and optical fiber using DNA molecules
3. Preliminary demonstrations of the optical force transducer

Specialized Resources Provided by Client:
Fluoresce microscope, optical fiber, reagents, and simulation tools

Anticipated Cost: _______________________________ Financial Resources Provided by Client: 1000

Preferred Students for the Project:
☑ Electrical Engineering ☐ Computer Engineering
☐ Software Engineering ☑ Other: Yalun Tang's team

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
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

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

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

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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:  

sdmay18-proj044

☐ Project Assigned:  


☐ Advisor(s) Assigned:  


### Client/Company/Organization:
Halil Ceylan, Director of
PROSPER and Professor in CCEE

### Project Contact:
Yang Zhang

### Project Title:
Autonomous health monitoring of transportation infrastructure using unmanned aerial vehicle (UAV)

### Project Abstract:
Unmanned Aircraft Systems (UAS), more commonly referred to as drones, offer unparalleled opportunities for performing cost-effective and efficient health monitoring of transportation infrastructure systems such as bridge, pavement, culvert, etc. The aim of this project is to utilize a UAV attached by a high-resolution (HD) camera or thermal camera, light detection and ranging (LiDAR) system to inspect transportation infrastructure conditions.

### Project goals:
1. Over the duration of two semesters, design a UAV based platform for transportation infrastructure condition monitoring.
2. Semester 1 – Provide design approach with proof of concept prototype UAV (commercialized or self-developed) based platform for the transportation infrastructure condition monitoring.
3. Semester 2 – Provide finalized UAV system that meets specifications as listed below and test it in the field.

### Design Specifications:
1. The UAV should have desirable fly height (400 ft.) and endurance (40 minutes).
2. The UAV should be able to be attached by a HD camera or a thermal camera for multiple images collection in 360 degrees.
3. System should have capability to go under the bridges to capture images and videos of under bridge system (camera systems can arranged to look upwards with a special, multi-functional gimbal).

### Expected Deliverables:
- Semester 1: Design approach with proof of concept prototype
- Semester 2: Working, finalized UAV system meeting the required specifications

### Specialized Resources Provided by Client:
- HD camera, thermal camera, and LiDAR.

### Anticipated Cost: ____________

### Financial Resources Provided by Client: None

### Preferred Students for the Project:
- Electrical Engineering
- Computer Engineering

### Other Special Skills: None
☐ 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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Project Approval – for use by ECpE Senior Design Committee

☑ Approved: sdmay18-proj045
☐ Project Assigned: 
☐ Advisor(s) Assigned: 
Client/Company/Organization: UnityPoint Clinic Weight Loss at West Des Moines

Submitter Name: UnityPoint Health Des Moines
Email: Vanessa.Calderon@unitypoint.org

Project Contact: Vanessa Calderon
Email: Vanessa.Calderon@unitypoint.org

Project Title: Electronic Scheduling Tool for Surgery Clinic

Project Abstract:
UnityPoint Clinic Weight Loss at West Des Moines specializes in weight loss – they provide dietary and exercise consultations as well as all of the visits leading up to surgery for those who want to go with bariatric surgery for weight loss. There are 31 visit types if you consider all of the combinations of providers and visit lengths and purposes for meeting that this clinic has:

Visit Type
1  Class
2  1st Consult - Surgeon/Dietician
3  2nd Consult - Surgeon/Dietician
4  Psychiatrist
5  Video Class
6  NurseVisit
7  HLP - Dietician, ARNP
8  Dietician, Specialty Nurse, ARNP
9  Dietician, ARNP
10  Dietician Only
11  Dietician, Specialty Nurse
12  Dietician, Specialty Nurse, PA
13  Dietician, PA
14  Surgery
15  Post Op - Visit 1 - Dietician, Surgeon
16  Post Op - Visit 2+
17  Post Op HLP - Dietician
18  Post Op MSD - Dietician
19  PreOp MSD - Dietician
20  Post Op HLP - Dietician, ARNP
21  Post Op HLP - Dietician, PA
22  Post Op HLP - ARNP
23  Post Op HLP - Dietician, SN
24  Post Op MSD - Dietician, SN
25  Post Op MSD - Dietician, ARNP
26  Post Op MSD - Dietician, ARNP, SN
27  Post Op MSD - Dietician,PA, SN
28  PreOp MSD - Dietician, ARNP
29  PreOp MSD - Dietician, PA
30  PreOp MSD - ARNP
31  PreOp MSD - Dietician, SN
As you can probably guess, this makes scheduling very difficult to meet all constraints without double booking resources or rooms, and without having space between the visits where surgeons or patients don’t wait.

An example is a patient who needs a 30 minute dietician(D), 20 minutes with a Physician Assistant (PA) and 40 minutes with an Specialty Nurse (SN). The dietician and PA must be next to each other on the schedule, so it cannot go D-SN-PA or PA-SN-D, but it could go one of these 4 combinations: PA-D-SN, D-PA-SN, SN-PA-D, SN-D-PA. There must be a rule to check that a room is open for 50 consecutive minutes (for the Dietician and PA) and that either before or after that 50 minutes, there are 40 minutes of SN time available (although that exam room used by dietian and PA room need not be available since she uses a separate room than any other resource).

One rule is they would always prefer the dietician sees the patient first, so prioritize the visits listed as D-PA-SN, SN-D-PA, PA-D-SN, SN-PA-D, in that order when the program searches for next available times. We could set a criteria that says “allow no more than 10 minutes between appointments” if none of these constraints could be met within, say, 2 weeks.

Recently, an engineering project determined a schedule layout that can accommodate all of these appointments. We would like your team to create a program that can search through when we need an appointment that is a combination of 1, 2, 3, or even 4 providers for a patient visit and find the best earliest next times/dates that we can offer the patient real-time when they need to schedule. We currently use the EMR (Electronic Medical Record) called EPIC, and we would like the solution to interface with this program and link to the schedule within this product.

---

**Expected Deliverables:**

Integrated Software Program (with EPIC) that searches to Accommodate Appointment Visits requiring Multiple Human and Capital Resources at varying times

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**Specialized Resources Provided by Client:**

We can put the students in touch with experts within the organization that deal with our electronic medical record (EPIC) as well as give advice to IT considerations.

---

**Anticipated Cost:**

**Financial Resources Provided by Client:**

Upon Approval on August 22nd ($5000);
Awaiting leader approval upon return from vacation

---

**Preferred Students for the Project:**

- [ ] Electrical Engineering
- [X] Computer Engineering
- [X] Software Engineering
- [ ] Other:

**Other Special Skills:** Interest in healthcare is preferred but not required; strong programming ability due to complexity of schedules. Advanced communication skills when working with clients who have limited technical experience with software.
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

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Project Approval – for use by ECpE Senior Design Committee

✓ Approved: sdmay18-proj046

☐ Project Assigned: ____________________________

☐ Advisor(s) Assigned: ____________________________
Client/Company/Organization: Kingland

Submitter Name: Matt Good Email: matt.good@Kingland.com

Project Contact: Email: 

Project Title: Data Analytic Tools for Inconsistency Detection in Large Data Sets

Project Abstract:
The project aims to develop a suite of tools to detect different types of inconsistencies in large-scale financial data generated on a daily basis. The tools will be used to build an information management system, which consists of several modules, including XML file parser (read and write XML files), database interface, and information processing algorithms (Hashing value computing, data cache and lookup, consistency checking). The project provides students will a full-loop information system implementation experience driven by a real-world application. The students will participate in architecture and algorithm design, implementation, and testing. They will be exposed to state-of-the-art SQL and/or No-SQL database systems, and learn about basic principles and implementation skills of information systems, such as consistency concerns, resolving performance bottlenecks, system usability, and understanding user requirements.

Expected Deliverables:
System architecture and algorithm designs (3 months), implementation (3 months), testing cases and user manual (3 months).

Specialized Resources Provided by Client:
Data sets and a server will be provided for Professor Ying Cai, who works with Kingland to oversee the project. Additional hardware such as laptops may be provided to students participating in this project.

Anticipated Cost: Financial Resources Provided by Client: 

Preferred Students for the Project:
- Electrical Engineering
- Computer Engineering
- Software Engineering
- Other: Other Special Skills: The students need to have Java programming experience. Knowing C# is 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
- 1 meeting per semester
Meeting ABET Criteria

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

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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:  

sdmay18-proj047

☐ Project Assigned:  

☐ Advisor(s) Assigned:  

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Client/Company/Organization:  Dr. Daniels

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

Project Contact:  
Email:  

Project Title:  
Office Door Kiosk for University Faculty

Project Abstract:  
This project will design and implement a secure office door kiosk system for use on faculty office doors. The resulting system will allow the faculty member to post notices, receive messages from students, allow students to contact faculty perhaps even by videochat, etc. The system's backend should support many faculty and integrate with the faculty member's wireless and desktop devices allowing them to update their statuses, receive messages, etc.

Expected Deliverables:  
An office door kiosk along with software to support the backend. Any needed software for faculty devices.

Specialized Resources Provided by Client:  
A VM for running the management system. A tablet or similar to be used as the kiosk.

Anticipated Cost:  
Financial Resources Provided by Client:  

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

Other Special Skills:  Some web development. Some android development.

Anticipated Client Interaction (estimate):  
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**Project Approval – for use by ECpE Senior Design Committee**

☑ Approved: sdmay18-proj048

☐ Project Assigned: 

☐ Advisor(s) Assigned: 

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---------------------------------------------

---------------------------------------------
Client/Company/Organization:  ISU- Human Compassionate Autonomy group

Submitter Name:  Anuj Sharma  
Email:  anujs@iastate.edu

Project Contact:  Chinmay Hegde  
Email:  chinmay@iastate.edu

Project Title:  Safe communication between lead and following vehicle

Project Abstract:
The overall goal of the project is to develop an autonomous vehicle that follows a human driven lead vehicle. The first step to accomplish this goal is to establish a reliable communication between lead and following vehicle. The communication link will be used to transmit trajectory information of the lead vehicle to the automated following vehicle. The technology used for transmission of information with be dsrlc radio and bsm messages following a standard protocols. These messages need to be received and transmitted to drive px in a usable format. Setting up of frequency of communication and protocol will be design element for this project

Expected Deliverables:
Demonstration of reliable trajectory communication between two vehicles

Specialized Resources Provided by Client:
All the equipment needed for the project will be provided by HCA group

Anticipated Cost:  
Financial Resources Provided by Client:  NA

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

Other Special Skills: Linux and C familiarity

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

☑ Approved: sdmay18-proj049

☐ Project Assigned: _______________________________________

☐ Advisor(s) Assigned: _______________________________________

__________________________________________________________
Client/Company/Organization: None

Submitter Name: Peng Wei
Email: pwei@iastate.edu

Project Contact: Peng Wei
Email: pwei@iastate.edu

Project Title:
Intelligent low-altitude air traffic management system

Project Abstract:
We want to build a software prototype to manage low-altitude air traffic, including cargo UAS (such as Amazon Prime Air or Google X), passenger eVTOL aircraft (such as Uber Elevate and Airbus Vahana), and recreational users (such as DJI phantoms). This software system and back-end database contains the following key components: 1) a big-data enabled back-end database that can handle thousands of aircraft trajectories in real time; 2) (optional) a key function to check if pre-departure flight plans are conflicting or not; 3) a key function to monitor and alert real air traffic when potential collision is detected; 4) (optional) a front-end user interface to interact with air traffic controllers. Students will

Expected Deliverables:
A working software prototype containing key components described in 1, 2 and 3. The system testing will be conducted with one or two actual DJI phantom aircraft and hundreds simulated UAS trajectories.

Specialized Resources Provided by Client:
Please search "NASA UTM", "Amazon Prime Air", "Uber Elevate", and "Airbus Vahana"

Anticipated Cost: ___________________________ Financial Resources Provided by Client: N/A

Preferred Students for the Project:
☑ Electrical Engineering
☑ Computer Engineering
☑ Software Engineering
☐ Other: Other Special Skills: aviation passion

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
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Project Approval – for use by ECpE Senior Design Committee

☐ Approved: sdmay18-proj050

☐ Project Assigned: 

☐ Advisor(s) Assigned: 

Client/Company/Organization: ISU EE dept

Submitter Name: Julie Dickerson Email: julied@iastate.edu

Project Contact: Julie Dickerson Email: julied@iastate.edu

Project Title: Develop lab interface for EE224 data collection

Project Abstract:
The goal of the project is to create a hardware and software platform to update the teaching laboratory experiments for EE224, Signals and Systems I. The goal is to allow the students to easily collect data for off-line analysis. The key concepts for the class include the linkage between time-domain and frequency domain, frequency filtering and spectral analysis. The team will have to suggest different technical approaches.

Expected Deliverables:
1. Develop a software interface for collecting data from a variety of sensor types, must be able to control sampling rate, bandwidth and allow for selection of basic filtering.
2. Create an inexpensive hardware board that allows multiple off the shelf sensors to be installed. The hardware must be inexpensive and commercially available.
3. Develop a set of laboratory experiments that teach students how to use the hardware and software.

Specialized Resources Provided by Client:

Anticipated Cost:_______________________ Financial Resources Provided by Client: should be sufficient.

Preferred Students for the Project:

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

Other Special Skills: Ability to work with commercial chips sets such as Arduino, software development on windows, understanding of basic principles of signals and systems

Anticipated Client Interaction (estimate):

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

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

☑ Approved:    

sdmay18-proj051

☐ 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:  

Machine Learning / AI / Big Data Analytics

Project Abstract:

Looking for CE and or SE students to demonstrate possibilities of employing pattern recognition, AI machine learning, predictive modeling, based on IBM Watson or similar, in analyzing data collected by a product assembly line stations and test stand. Focus on analyzing cycle times predicting machine maintenance, identify piece part problems and etc...
Project scope will be limited to one existing product line.
Students will receive support in areas of statistical analysis, necessary IT resources and IT support from Danfoss staff.

Expected Deliverables:

- Approximately 30% of allocated time to setting up necessary environment (IBM Watson or similar) remaining time to devise solutions like:
- analyzing station based cycle times to predict maintenance, detect equipment malfunctions and identify potential piece part problems;
- forecasting shift and daily production numbers and inventory, etc.
- final solution presentation to DPS Leadership - depending on schedule and results there is a potential for international travel with expenses paid by DPS

Specialized Resources Provided by Client:

- Dedicated access to "sand box system" based on Tesla K80 HPC and machine learning accelerator(s) to have unconstrained freedom in setting up necessary systems and creating solutions
- Access to global network of Subject Matter Experts at Danfoss Power Solutions to help with concepts, roadblocks and etc...

Anticipated Cost:  

Financial Resources Provided by Client:  8000

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
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Meeting ABET Criteria

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

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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:           sdmay18-proj052
☐ Project Assigned:  
☐ Advisor(s) Assigned:  

________________________________________

________________________________________
Client/Company/Organization: UAVX LLC

Submitter Name: Radek Kornicki Email: radek@uavx.com

Project Contact: Radek Kornicki Email: radek@uavx.com

Project Title:

AR enabled ground station

Project Abstract:

Create a basic ground station software solution to be deployed on either Linux or Android based OS that integrates with Google Glass for delivering Augmented Reality information to the user.

Expected Deliverables:

Define necessary set of minimum functionalities of a basic drone ground station system compatible with MAVLINK. Create a basic ground station app capable of interfacing to Google Glass in order to deliver relevant and timely information to the drone operator.

Specialized Resources Provided by Client:

iMX6 based handheld ground station
Google Glass

Anticipated Cost: [ ] Financial Resources Provided by Client: 5000

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
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Meeting ABET Criteria

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

☑ Approved: sdmay18-proj053
☐ Project Assigned: ________________________________
☐ Advisor(s) Assigned: ________________________________

______________________________
Client/Company/Organization: Optical Operations LLC.

Submitter Name: Mason Ogbourne Email: mpgbourne@opticaloperations.com

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

Project Title:
Integration of personnel tracking in an Augmented reality environment

Project Abstract:
The goal of this project is to develop a system to track the location of personnel, and integrate the system into an augmented reality environment. This project builds off Optical Operation’s previous senior design project. This is a system for tacking personnel in an Industrial environment, such as a construction site or mine. As it will be carried on personnel, the system must be portable. It must also be cost effective and scalable for a large number of personnel. The approach of this project is to have the students explore several potential system solutions, such as GPS, RFID, UWB, or WPS, select the most ideal solution, then construct it. It will then be integrated into the augmented reality environment on Microsoft Hololens.

Expected Deliverables:
Aug 21-Sept 15
• Understand Industrial Constraints
• Understand Project Constraints

Sept 16 – October 15
• Come up with 4 potential solutions
• Develop Pros and cons for each solution
• Deliverable: Write Solution Proposal for each system

October 16 – November 1
• Narrow number of potential solutions to 2
• Deliverable: Expand solution proposal for each solution

November 2 – November 10
• Deliverable: Select most ideal solution from the proposals

November 11 – End of semester
• Deliverable: Develop Parts list for system capable of tracking 6 people

Jan 8 – Feb 28
• Deliverable: Construct system to track personnel

Mar 1 – End of semester
Deliverable: Integrate system into the augmented reality environment on Microsoft Hololens
Deliverable: Demonstrate the system tracking six people

Specialized Resources Provided by Client:
• Office space in Research Park
• Microsoft Hololens
• Raspberry Pis
Anticipated Cost: __________________________  Financial Resources Provided by Client: __________________________

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

Other Special Skills: C#, Python

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
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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:  

☐  Project Assigned:  

☐  Advisor(s) Assigned:  

sdmay18-proj054
Client/Company/Organization: Suraj Kothari

Submitter Name: Victory Omole Email: vtomole@iastate.edu

Project Contact: Suraj Kothari Email: kothari@iastate.edu

Project Title: c48

Project Abstract:

GCC and Clang are the most popular C compilers. Unfortunately, these compilers are extremely complex. Most developers treat these tools as black-boxes because it takes someone of considerable expertise to understand the source code of these projects. Clang is easier to understand than GCC because it uses LLVM as a back-end that will take care of code optimization. Clang is written in a mixture of C and C++. It would be nice if a compiler was entirely written in C so that developers do not carry the cognitive load of switching between C and C++ when studying the compiler. That compiler would be c48. The reason it is called c48 is because any intermediate-advanced C programmer would be able to read and understand its source code in less than 48 hours. There are a couple of easy to understand compilers in the wild, such as 8cc: https://github.com/rui314/8cc. The problem is that 8cc is not an optimizing compiler. c48 It will generate LLVM code like Clang to handle the optimization of the code. This is a student-developed project.

Expected Deliverables:

September: Self hosting subset compiler.
October: Compiler can output "useful" error messages and warnings after walking the abstract syntax tree.
November: Work on the type checker.
December-January: c48 is ANSI C compliant. Completion of prototype.
February-April: Use c48 for writing "medium programs" (500-2000 lines). Let friends and faculty use the compiler so that we can debug errors and improve its performance.
May: c48 may be deemed "production ready".

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: Proficiency in the C programming language.

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

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This project involves students from a variety of programs, i.e., CprE, EE, and SE
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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: sdmay18-proj055

☐ Project Assigned: ________________________________

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

Submitter Name: Srikanta Tirthapura Email: snt@iastate.edu

Project Contact: Email: 

Project Title: 

**Synthetic Database Generation**

Project Abstract:

The goal of the project is to generate (semi)-synthetic data that is similar to data that a client has within her site. The client is unwilling to share the original data with the software developer for a number of reasons, including privacy and the presence of sensitive identifiers. So, she wants to share a database that is "close" to the real data according to some criteria, yet is generated synthetically without using any real identifiers.

Expected Deliverables:

A synthetic data generator for RDBMS data that can generate data that yields identical results as the real data on certain types of SQL queries.

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: Basic knowledge of databases, interest in algorithm design.

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
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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: sdmay18-proj056

☐ Project Assigned: ____________________________________________

☐ Advisor(s) Assigned: ____________________________________________

______________________________________________________________
Client/Company/Organization:  Gary Tuttle - ECpE

Submitter Name:  Gary Tuttle  
Email:  gtuttle@iastate.edu

Project Contact:  
Email:  

Project Title:  
Bicycle lidar warning system

Project Abstract:  
The goal of the project is build a system to alert bicycle riders when a vehicle is approaching from the rear. The system should be compact and easily mounted on the rear seat post of a bicycle. Of course, it must be battery powered, with a reasonable battery life. It should be able to detect a car or truck at a distance of 50 meters and provide a clear signal to the rider that a vehicle is approaching, using either LEDs, an un-ambiguous audio signal, or both.

Expected Deliverables:  
A complete working warning system prototype with hardware and software, as needed

Specialized Resources Provided by Client:  
none

Anticipated Cost:  
Financial Resources Provided by Client:  250

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

Other Special Skills:  Microcontroller programming. PCB design.

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

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

☑ Approved: sdmay18-proj057

☐ Project Assigned: ________________________________

☐ Advisor(s) Assigned: ________________________________
5. Identify possible testing/verification scenarios -- (Week 5);
6. Identify references in terms of research literature and other technical documents to be read by the students -- (Week 6)
7. 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...
8. Provide a draft for the financial analysis of the purchases/resources needed for the identified test-cases/scenarios - (Week 10);
9. 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;
10. Revised version of the design document and the poster, along with the presentation slides -- week 14.

Specialized Resources Provided by Client:
TBD

Anticipated Cost: ___________________  Financial Resources Provided by Client: TBD

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:

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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, and modern engineering tools necessary for engineering practice
- ☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

Project Approval – for use by ECpE Senior Design Committee
- ☑ Approved: sdmay18-proj058
System and App for Managing General Faculty/Staff Parking on ISU Campus

Project Abstract:

General Faculty/Staff parking on ISU campus is operated on a first-come-first-serve basis. It is often the case that faculty and staff will be circling their preferred parking lot, and then move to the next one, if the first is fully occupied, and so on. This wastes a lot of time and gas, and increases the CO2 emission. The objective of this project is to develop a system that tracks the occupancy and availability of parking stalls in general faculty and staff parking lots. This status will be sent to a server, and can be accessed using apps on smart phones and tablets, and will also be accessible from computers using web browsers. Users can therefore inspect availability of parking in different parking lots and decide on how to proceed.

The project will explore the use of different types of sensors, including optical, pressure, ultrasound, and cameras, that can be used to detect parking stall occupancies. The cost, ruggedness, reliability, accuracy and energy consumption of sensors will be main determining factors for the selection of the sensors. The sensors will be deployed in at least one of the general faculty/staff parking lots and will be experimented with in order to provide a proof-of-concept.

Expected Deliverables:

1. Sensors to determine parking stalls occupancies.
2. Software to control the operation of the sensors and to relay the parking stalls status to the server using wired or wireless communications.
3. Server program to collect sensor data, store the information and deliver it to apps
4. An Android app for viewing the status of parking lots, and parking stalls, in order of preference.
5. An IOS app for viewing the status of parking lots, and parking stalls, in order of preference.
6. Design and implementation documentation, including test results.

Specialized Resources Provided by Client:

Expected Cost: Financial Resources Provided by Client:

Preferred Students for the Project:

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

Other Special Skills: Basic knowledge of sensors; Android programming; IOS programming;
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
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Meeting ABET Criteria

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Project Approval – for use by ECpE Senior Design Committee

- ☑ Approved: sdmay18-proj059
- ☐ Project Assigned: 
- ☐ Advisor(s) Assigned: 

Senior Design Project Proposal Form

Dependable Networking and Computing (DNC) Research Group at ISU

Client/Company/Organization: ECpE

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

Project Contact: Email:

Project Title: Software-Defined-Radios (SDR) for Cyber-Physical Systems

Project Abstract:

Tightly integrating sensing, networking, computing, and control with physical systems and processes, cyber-physical systems (CPS) are expected to transform the physical world around us and the way we interact with it. As an emerging intellectual discipline, CPS provides the science and technology foundations for Internet of Things (IoT), Industrial Internet, Industry 4.0, augmented reality, smart grid, advanced manufacturing, smart policing, smart transportation, smart planet, and so on. CPS is expected to enable the third wave of Internet evolution, which, as explained by the Internet pioneer and entrepreneur Steve Cave in his book “The Third Wave”, is expected to open up opportunities of innovation in areas of excellence in CPS application domains (e.g., central Iowa).

A foundation for the CPS vision is trustworthy real-time wireless networking. Despite over a century of practice in wireless systems, we are still at the infancy of CPS wireless networking, and there exist ample opportunities to innovate and to lead the evolution of CPS wireless networking solutions and their applications. Enabling whole-stack innovation at various layers of wireless systems, software-defined-radios (SDRs) have become instrumental platforms for imagining, learning, prototyping, and applying transformative CPS wireless solutions. However, existing SDRs mostly focus on physical-layer innovation without strategically addressing its interface and integration with the rest of wireless systems. In this project, we will comparatively study different hardware and software approaches to SDR, develop effective interfaces between SDR physical layer implementations and the rest of wireless systems for system-level integration, and then prototype innovative CPS wireless solutions using the selected SDR platforms.

Through this project, students will have the opportunity to learn about CPS and CPS wireless, to experiment with various SDR platforms (e.g., OpenAirInterface, GNU Radio/USRP), and to develop innovative CPS wireless solutions. Students will also have the opportunity to work in a team and with graduate students and Prof. Hongwei Zhang (who has ventured through the evolution of wireless sensor networks and CPS in the past 15 years). 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:
* August - September, 2017: study CPS and CPS wireless, survey SDR platforms
* October, 2017: set-up and initial experiment with various SDR platforms
* November - December, 2017: rigorous comparative study of various SDR platforms
* January - March, 2018: prototyping of CPS wireless solutions using the selected SDR platform(s)
* April, 2018: demonstration and report

Specialized Resources Provided by Client:
SDR platforms, CPS wireless algorithms
### Anticipated Cost: __________________________

Financial Resources Provided by Client: __________________________

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

Other: Ideally, the team shall include members in EE and CprE; having members in SE may be of value too.

#### 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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- ☐ 1 meeting per semester
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#### Meeting ABET Criteria

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

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- This project involves students from a variety of programs, i.e., CprE, EE, and SE
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<td>☑ Approved: sdmay18-proj060</td>
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<td>☐ Project Assigned:</td>
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<td>☐ Advisor(s) Assigned:</td>
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Client/Company/Organization:  Iowa State University

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

Project Contact:  __________________________  Email:  __________________________

Project Title:  Impact of High Photo-voltaic Penetration on Distribution Systems

Project Abstract:
Alternate and private forms of generation are becoming popular against the traditional utility provider. Especially, solar PV generation at distribution level is rising in Iowa due to high solar potential. With growth in distributed generation, the power utilities are observing new trends in the distribution feeder such as over-voltage, reverse power flow etc. Most utilities are finding that they are having increased difficulty meeting these changes with their aging infrastructure. The goals of the project will be:

1. Simulate a real world distribution feeder owned by Alliant Energy with high solar PV penetration.
2. Assess the impact of high PV penetration on voltage profile of the feeder for the worst case scenarios such as high generation, low demand etc.
3. Analyze and compare the impact of residential PV and community solar PV generation
4. Find some solutions or guidelines that would benefit Alliant Energy to prevent future problems associated with high solar PV penetration.

OpenDSS/GridLabD and MATLAB softwares will be used for the simulation and analysis. OpenDSS/GridLabD are open source platforms and can easily be grasped. Basic understanding of electric power system (EE303) will be required for the project.

Expected Deliverables:
1. A working simulation model of a real world feeder with high PV penetration
2. Comparison between impact of residential PV and community solar PV;
3. At least one solution or guideline to prevent problems with solar PV

Specialized Resources Provided by Client:
Simulation software (either openDSS or Synergy)

Anticipated Cost:  __________________________  Financial Resources Provided by Client:  __________________________

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

Other Special Skills: MATLAB, Power system analysis (power flow)

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
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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
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Project Approval – for use by ECpE Senior Design Committee

☑ Approved: sdmay18-proj061
□ Project Assigned:
□ Advisor(s) Assigned:
Client/Company/Organization: ECpE;

Submitter Name: Rana Biswas
Email: biswasr@iastate.edu

Project Contact: 
Email: 

Project Title: Design and fabrication of enhanced solar modules

Project Abstract: The goal is to design and fabricate solar modules with enhanced performance. The modules should be able to collect light more efficiently and have superior performance in low light conditions. In addition, the temperature of the modules should be controlled to run cooler in typical daylight conditions. Fabrication will include proof of concept.

Expected Deliverables: Design of improved solar modules (3 mo.). Proof of concept of fabrication to improve light collection and cost/performance analysis (6 mo.)

Specialized Resources Provided by Client: Infrared imaging camera. Test solar module. It will be coordinated with a similar project initiated by an Ames High student.

Financial Resources Provided by Client: Access to current voltage measuring instrumentation

Anticipated Cost: 

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

Other Special Skills: Innovative thinking. Fabrication 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
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Project Approval – for use by ECpE Senior Design Committee

☑ Approved:                   sdmay18-proj062
☐ Project Assigned:  
☐ Advisor(s) Assigned:

________________________________________________
________________________________________________

________________________________________________
**Client/Company/Organization:**  Iowa State University  

**Submitter Name:**  Liang Dong  
**Email:**  ldong@iastate.edu  

**Project Contact:**  Liang Dong  
**Email:**  ldong@iastate.edu  

**Project Title:**  Smart Wireless Ag Sensors for Measurement of Soil Water Contents  

**Project Abstract:**  
The goal of the project is to develop, evaluate, and deploy a number of smart sensors for real-time measurement of soil water contents in agriculture. The sensors are to be an alternative to conventional soil water content monitoring involving colorimetric, spectroscopic, and electrochemical analyses in the laboratory. The sensors will be portable and able to measure chemical properties including pH, conductivity, potassium, nitrate and phosphate in agricultural soil water. In collaboration with the Agronomy Department and the Plant Sciences Institute at Iowa State, the team will design, fabricate, characterize and evaluate the sensors, and then deploy them in their greenhouse and field to monitor dynamic changes in soil water contents over time as crops grow.  

Various new sensor technologies will be further evaluated in terms of sensitivity, specificity, reliability, and durability, and field deployability. New sensor designs will be made to improve sensor performances. A small sensor network will be made. Data platform will be built to collect data from sensors wirelessly. A user interface and app will be developed for the sensor system deployed in greenhouse and field.  

The team will work with plant scientists, agronomists, and other engineers to develop the proposed system. The team will work in the BioLab, Sensors Lab, and plant sciences Institute. The team will meet on a weekly basis.  

**Expected Deliverables:**  
Expected deliverables include a portable sensor system able to detect pH, conductivity, potassium, nitrate and phosphate in agricultural soil, a data platform able to collect data from sensors wirelessly, a user interface and app for the sensor system.  

**Specialized Resources Provided by Client:**  
Microfabrication facility, computer workstation, sensor calibration platform  

**Anticipated Cost:**  
**Financial Resources Provided by Client:**  2000  

**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
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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, and modern engineering tools necessary for engineering practice | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ✓ 4 |

Project Approval – for use by ECpE Senior Design Committee

☑ Approved: sdmay18-proj063

☐ Project Assigned:

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

Randall Geiger and Degang

Submitter Name: Chen  

Email: rlgeiger@iastate.edu

Project Contact:  

Email:  

Project Title:  

Sound Effect Devices for Musicians

Project Abstract:

This project will involve the design and testing of a universal sound effects device targeting use by live entertainment musicians. There are numerous sound-effects devices available that provide interesting and creative effects. These include wah-wah, fuzz, overdrive, phasing, flanging, chorus, vibrato, tremolo, rotary speaker, octave dividers, and a host of others. These devices usually have an input coming from a guitar or some other musical instruments. A large number of these devices have emerged over the years but the demand exists for other devices that produce effects that are more interesting or novel than what is available or are easier to use and integrate. The Guitarworld magazine (Nov 30, 2015) recently reviewed 50 such devices that have been used over the years. Other sound effects devices are used to create unique sounds and these might include synthesizers based upon a keyboard entry or theremin-type device. The latter are actually musical instruments themselves but the sounds they are capable of producing are completely different from that attainable by any physical musical instruments.

Expected Deliverables:

Based upon student interests, this project could take on one of three different approaches. One could be the development of another type of sound-effect device. A second could be the development of a system that interfaces several existing devices with a suitable mixing strategy so that musicians can control the mix real-time possibly by hand, head, or foot movements in a way that offers improvements over existing interface methods. A third could be the development of a sound generation device such as a theremin with an optical interface that will produce interesting sounds different from what is currently available. Depending upon the focus, the deliverables would include the development of a prototype device and an assessment of the benefits and limitations of the prototype by a small group of individuals that are not a part of the design team.

Specialized Resources Provided by Client:

As described in this project description, the flexibility is intentionally broad to allow individual creativity and interests to dictate the direction of the project. Only students that are interested in exploring their creativity or that have ideas that they would like to bring to the prototype level should consider this project. Experience as a performer or performing tasks associated with those of an audio engineer would be most useful but are not required.

Anticipated Cost:  

Financial Resources Provided by Client:  

Preferred Students for the Project:

☑ Electrical Engineering
☑ Computer Engineering
☐ Software Engineering

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
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  ☐ In person, ☐ Over the phone, ☐ Web / video conferencing
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☐ 0 ☐ 1 ☐ 2 ☐ 3 ☑ 4

This project requires students to identify, formulate, and solve engineering problems
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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: sdmay18-proj064

☐ Project Assigned: 

☐ Advisor(s) Assigned: 

Project Title:
Drone-Assisted Energy Delivery

Project Abstract:

This project will focus on developing a method for drone-assisted energy delivery for creating and operating wireless sensor networks which are a critical component of the Internet of Things (IoT). There are fundamental trade-offs in data communication networks between distance, bandwidth, spectrum allocation, and power. When network nodes are tethered to the power distribution grid, power is of secondary concern but on untethered nodes, a source of power is of critical concern and many of the emerging IoT applications will come to fruition only if a practical source of energy becomes available. There is a lot of research ongoing on harvesting energy to power these untethered nodes. However, it appears that there are fundamental physical limits on essentially all proposed methods of harvesting energy that will doom these approaches to low-distance, low data-rate applications with limited availability and reliability.

Drones are widely used in military applications for reconnaissance and unmanned targeted attacks and by hobbyists primarily for mobile camera applications. Proposals for other applications such as package delivery have been forwarded by Amazon and others.

This project will focus on using drones as a system component for energy delivery to untethered nodes and for the placement of sensors or nodes in a sensor network to enhance reliability and physical access. Energy will be delivered-scheduled from a tethered location to an untethered location on-demand. While transferring energy, the drone will dock with the untethered node rather than "hoover" to minimize energy loss. And while serving as either a network node or a data acquisition node, the drone may remain docked for extended periods of time. It is envisioned that these drones can become extremely low-cost commodity that can be readily replaced if failures do occur thereby achieving good availability and system reliability.

Aspects of this project will include developing drone docking methods, methods of drone-assisted energy delivery, and the creation of wireless sensor nodes that can either augment existing sensor networks or independently form a dynamically reconfigurable sensor network. The project will also include a WEB interface that can be used to interface data collected from the network with the cloud.

It is expected that participants will use existing commercially available drones and commercially available network components to develop and demonstrate performance capability of these drone-assisted networks.

Expected Deliverables:
Review of methods of drone-assisted network creation and drone-assisted energy delivery. Development of a low-cost drone-assisted network that can be used for both energy delivery and the creation of wireless sensor networks using hovering or docked drones as nodes. Demonstration of the performance of this network using commercially available drones and network components.

Specialized Resources Provided by Client:
Anticipated Cost: _____________________________  Financial Resources Provided by Client: _____________________________

Preferred Students for the Project:

☐ Electrical Engineering  ☐ Other Special Skills: An UAS (unmanned aircraft systems) pilots license and/or experience flying drones would be useful but is not required.

☐ 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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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:  sdmay18-proj065
☐ Project Assigned:  

☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4
☐ Advisor(s) Assigned:

______________________________________________

______________________________________________
Client/Company/Organization: 

Submitter Name: Randy Geiger and Degang Chen  
Email: rlgeiger@iastate.edu  
Project Contact:  
Email: 

Project Title: Anti-counterfeit Electronic Components

Project Abstract:
This project will focus on the development of an anti-counterfeit strategy for integrated circuits. There are varying estimates about the number of counterfeit electronic components that are in the standard component supply chain. According to a recent Scientific American article, the US government estimates that up to 15% of the components in their inventory for spare and replacement use are counterfeit. Counterfeit parts are extremely difficult to detect since the counterfeiters go to extreme measures to make the counterfeit parts look and act as if they are authentic. Though the counterfeit market detracts from the market potential from legitimate manufacturers such as Intel, Samsun, Texas Instruments, … the major concern is the degraded reliability associated with counterfeit parts since there are no known ways to predictably and nondestructively assess reliability of individual components. In this project, an authentication circuit will be designed that can be embedded in any integrated circuit by the manufacturer. The authentication circuit will contain a unique code and when a customer receives a part, they will be able to check with the manufacturer to see if the code in their part agrees with the unique code of the manufacturer. A PUF (physically unclonable function) will be used to create the unique code. To make the authentication circuit attractive to both the semiconductor manufacturers, it must be extremely small, require no additional pins, and have no affect on performance of the circuit during normal operations. The client will describe a way this can be achieved. This project could be considered a complement to the ongoing DARPA SHIELD program which is looking at an alternative way for authentication using a companion “chiplet” approach. The proposed project does offer some benefits over what is achievable with the SHIELD program.

Expected Deliverables:
Prototype design of a circuit that can be used for anti-counterfeit authentication. Hopefully this circuit can be designed so that it can be fabricated and tested during the second semester.

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: All students that have completed EE 330 should have the background needed to complete this project. At least one team member should have completed EE 330 and team members that have not completed EE 330 should be registered in the 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
  - ☐ 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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Project Approval – for use by ECpE Senior Design Committee

☑ Approved: sdmay18-proj066

☐ Project Assigned:

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

Submitter Name: Randy Geiger Email: rlgeiger@iastate.edu

Project Contact: ___________________________ Email: ___________________________

Project Title: Latent Damage and Reliability in Semiconductor Devices

Project Abstract:

This project will focus on a study of latent damage in integrated circuits and its corresponding effects on reliability. Latent damage is damage that has been introduced but that cannot be detected or observed with existing non-destructive methods. Some scholars claim that latent damage does not exist but others have provided measurements that show experimentally that latent damage can be introduced in some circuit structures. Common causes of damage in integrated circuits are ESD associated with static noise in the environment and short high-voltage power supply transients caused by lightning strikes on power lines. When some integrated circuits in a system are destroyed by such events, a standard repair approach is to replace non-functioning modules or components to restore system performance. But questions about the reliability of the repaired system remain if latent damage exists in the properly functioning modules and components that were not replaced.

In this project, an experimental study of the effects of stress near the failure limit on standard semiconductor devices will be made to assess whether latent damage occurs and, if it does, to assess the impact on reliability. Stress will be introduced with short-duration high voltage spikes applied to appropriate pins on standard commercial integrated circuits that are just below the failure level. Accelerated lifetime tests will then be conducted with stressed parts and unstressed parts to assess whether the stress has any significant impact on lifetime and reliability. An industry standard test oven is available for conducting accelerated lifetime tests.

The role of the computer engineers on this project will be primarily to support the accelerated lifetime tests whereby a microcontroller will likely be used to determine when each device fails during testing. Though this is a research project focusing on latent damage, there are considerable job opportunities in industry for engineers focusing on fault diagnosis and reliability of semiconductor devices.

Expected Deliverables:

Review of existing studies on latent damage in semiconductor devices, design of a test bench for introducing short-duration high-voltage transients in semiconductor devices, design of an accelerated testing platform for conducting accelerated lifetime tests, test results to assess the level of latent damage that occurs in select commercial integrated circuits.

Specialized Resources Provided by Client: ______________________________________________________

Anticipated Cost: ___________________________ Financial Resources Provided by Client: ____________________________

Preferred Students for the Project:

☐ Electrical Engineering  ☐ Computer Engineering

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

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This project involves students from a variety of programs, i.e., CprE, EE, and SE
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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:  sdmay18-proj067

☐ Project Assigned:  

☐ Advisor(s) Assigned:  

Client/Company/Organization: Advanced Analytical Technology

Submitter Name: Pierre Varineau Email: pvarineau@atti-us.com
Project Contact: Bruce R. Boeke Email: BBoeke@atti-us.com

Project Title:
Microbial Count reader

Project Abstract:
This is a simple microbial plate counter/incubator consisting of a small, thermally insulated unit allowing for growth of bacteria, with real-time detection and counting of colonies using a simple low-cost, off-the shelf USB camera. The system will include software for evaluating real-time colony growth.

Expected Deliverables:
A small, low-cost insulated incubator for 1 microbial plate, with a real-time monitoring of colony counts using a low-cost USB camera. Success will be defined on how well the system matches human manual counting of colonies.

Specialized Resources Provided by Client:
Client will provide access to any 3-D rapid prototypers, and also parts (USB camera).


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

☑ Other Special Skills: Rapid prototyping, electrical design, programming

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
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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

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

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

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

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

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

- **Approved:**

- **Project Assigned:**

- **Advisor(s) Assigned:**
Client/Company/Organization: Sodima Solutions LLC

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

Project Contact: __________________________ Email: __________________________

Project Title: Energy blockchain implementation for free market P2P energy trading

Project Abstract:
Create a platform for peer-to-peer energy trading. Homes and businesses would be incentivized to produce energy, many times clean/renewable, if they could profit from selling it to their neighbor. The infrastructure is there due to the utility company, but there lacks a trusted medium for exchanging energy.

Project Goals:
1. Create and deploy a smart contract on a blockchain implementation (hyperledger, ethereum) that tracks all assets energy transactions.
2. Build and deploy a web application for visualizing this "market".
3. Design and prototype a device for measuring on-premises energy transfer and writes directly to the blockchain via a IoT medium.
4. Write a review/white paper of the completed system including any potential security faults, grid feasibility, and market implementation analysis.

Stretch Goal:
5. Design an automation to buy and sell these smart contracts in an optimized pattern to maximize profits while always providing electricity to the premises.

Feasible tech approach: Ethereum with Solidity Smart Contracts, Truffle.js, Pyethereum, Node.js web app, AWS servers, IBM services for market optimization

Expected Deliverables:
Mid-October: Submitted design proposal for the system. How will it work and what are all the necessary steps to build this system.
Late-December: IoT prototype v1, smart contract working locally, Barebones web app.
Mid-March: Deployed version of smart contract, web app, and IoT. Industry reach out for review and feedback.
May: Full tested smart contract, web app, and IoT device working as expected. White paper to accompany working product.

Specialized Resources Provided by Client:
Any necessary (within budget) electrical measuring devices to adequately measure power meters and send to the cloud.

Anticipated Cost: ________________  Financial Resources Provided by Client: $500 budget

Preferred Students for the Project:
**Senior Design Project Proposal Form**

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

### Anticipated Client Interaction (estimate):

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

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

- ✔ Approved: 

  sdmay18-proj069

- □ Project Assigned: 

  ____________________________________________

- □ Advisor(s) Assigned: 

  ____________________________________________

  ____________________________________________
Client/Company/Organization: Ron Zickfoose

Submitter Name: Ben Zickfoose
Email: bjz@iastate.edu

Project Contact: James McCalley
Email: jdm@iastate.edu

Project Title:
Power systems analysis in an induction type wind turbine

Project Abstract:

Ron Zickfoose is building a wind turbine on his property. It is a 110-ft. tall, 4kW induction type wind turbine of his own design. The power utility requires proof that the generator will not cause any ‘islanding’ within the power grid and will not be a hazard. There will need to be detailed research, analysis, and description of the capabilities, limitations, and any possible hazards associated with the wind generator with the possibility of drafting an academic paper describing the role of synchronous speed and islanding in an induction generator. Additionally, there is also further control work that will need to be completed as well for the optimal operation of the wind turbine. This will include bringing the generator and gearbox into the ISU wind lab to connect the generator shaft to another motor to simulate the wind speed and calculate the optimal wind speed bandwidth for the generator motor. Once this is determined then an anemometer will need to be integrated into the circuit to control the switching of the generator within the determined wind speed bandwidth. We will also possibly create a GUI to show the current wind speed and power output of the generator on the client’s computer.

Expected Deliverables:
1) One line, three line, and control wiring blueprints with the possible addition of mechanical prints and a sitemap for the total blueprint package.
2) Possibly write a GUI to show the current wind speed, if the turbine is running, and the power output.
3) A detailed paper giving to present to the power utility engineers to prove that power feedback onto the grid will not be an issue with the possibility of producing an academic paper describing our findings. A presentation to the engineers at the power utility will also be included in this.
4) A detailed paper giving the description of the findings from the wind speed analysis experiment used to find the wind speed bandwidth.
5) The layout and design of the control wiring for the wind turbine.

Specialized Resources Provided by Client:
The shaft coupler and motor mounts to be used in the wind speed analysis experiment. Any extra wiring and parts needed.

Anticipated Cost: ____________________
Financial Resources Provided by Client: Any food, drink, and lodging related to any site visit.

Preferred Students for the Project:

☑ Electrical Engineering
☐ Computer Engineering

Other Special Skills: Use of AutoCad to draft blueprints, programming ability to write a GUI, research, and power...
Senior Design Project Proposal Form

☐ Software Engineering
☐ Other:
systems analysis for presentation to the power utility

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

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This project requires students to identify, formulate, and solve engineering problems
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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: sdmay18-proj070