Senior Design Project Proposal Form

Client/Company/Organization: Argonne National Laboratory

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

Project Title: Crawling for Data Breach Reports

Project Abstract:
Reports of data breaches come in many forms online. Several companies and government agencies issue periodic summary reports with statistical data and overall trends, researchers and journalists publish reports of individual breaches (or the resulting fall-out and resolution of them), and individual companies may be required to disclose breaches to customers or regulatory agencies. An information security manager trying to keep tabs on the threat profile facing his or her employer will be very challenged just to keep up with the current deluge of such reports, let alone make sense out of them and put the knowledge to work. The goal of this project is to develop a machine learning agent that can search the internet to identify new reports of breaches, while ignoring other information, and save the relevant details into a database for later processing. This will require:

1) identifying starting points for crawling,
2) creating working definition of a "breach report",
3) creating a training dataset from selected sites,
4) identifying and implementing the appropriate machine learning algorithms for content parsing and classification, and
5) implementing a storage mechanism for the collected data, including a UI for inspection and management, and
6) developing a testing strategy to determine the accuracy and reliability of the tool.

Crawling and classification code will be written in Python, making use of existing open source libraries wherever possible.

Expected Deliverables:
Summary report in IEEE format detailing literature review, methodology, and testing results
Archive of developed source code

Specialized Resources Provided by Client:
Examples of breach reports
Examples of sites with relevant content
Guidance on ML algorithm selection and implementation

Anticipated Cost: Financial Resources Provided by Client: None

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

☑ Computer Engineering
☑ Software Engineering
☑ Other: Cyber 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:

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

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

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

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

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

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

Project Approval – for use by ECpE Senior Design Committee

☑ Approved: sddec19-proj001
☐ Project Assigned: 
☐ Advisor(s) Assigned:
Senior Design Project Proposal Form

Client/Company/Organization: Argonne National Laboratory

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

Project Title: Machine Learning for High-Risk Code Detection

Project Abstract:
The pace at which new cyber applications are written and published is constantly increasing. Paradigms such as continuous integration, continuous delivery, and DevOps have drastically intensified the expectations for code to be taken from idea to production in a minimal amount of time. Enabling this requires a large deal of automation, but many security defects cannot reliably be identified by automated methods alone. This means that human analysts are still required to inspect code, but cannot possibly keep up with all changes in a large application or ecosystem. Machine learning may, however, be able to help focus these analysts on areas of code that are at the highest risk of such defects. In order for this to work, these algorithms need a solid training dataset. One possibility is to combine the publicly available information on software security defects (such as the National Vulnerability Database) with source code available for open source projects, to attempt to identify the code the is indicative of a potential vulnerability. The goal of this project is to develop a machine learning agent capable of giving an estimate of the likelihood of a software defect for a given change diff, having been trained on publicly available information, for at least one dynamically-typed programming language. This will require:

1) identifying two or more open source projects which have reliable histories of vulnerability information and change logs,
2) development of a tool capable of ingesting the relevant data and storing it in a format suitable for machine learning,
3) identification and implementation of an appropriate machine learning algorithm for performing a regression on a given diff to return a risk score,
4) testing of the developed algorithm on the identified projects to determine accuracy within and between applications

Code will be written in Python, making use of existing open source libraries wherever possible.

Expected Deliverables:
Summary report in IEEE format detailing literature review, methodology, and testing results
Archive of developed source code

Specialized Resources Provided by Client:
Examples of projects and vulnerability database
Guidance on ML algorithm selection and implementation

Anticipated Cost: None
Senior Design Project Proposal Form

Preferred Students for the Project:

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

Other Special Skills: 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
    ☐ In person, ☐ Over the phone, ☐ Web / video conferencing

Meeting ABET Criteria

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

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

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

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☑ 4

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

☐ 0 ☐ 1 ☑ 2 ☐ 3 ☑ 4

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

☐ 0 ☐ 1 ☑ 2 ☐ 3 ☑ 4

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

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☑ 4

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

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☑ 4

Project Approval – for use by ECpE Senior Design Committee

☑ Approved: sddec19-proj002
☐ Project Assigned:
☐ Advisor(s) Assigned:
Senior Design Project Proposal Form

Client/Company/Organization: Argonne National Laboratory

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

Project Title: Insider Threat Dataset Creation

Project Abstract:

Many researchers have put time into developing algorithms to perform log analysis and identify potentially malicious insider users in information systems. However, often they must use data that cannot be shared due to privacy or confidentiality restrictions, meaning that it is difficult to evaluate the generalizable performance of such algorithms or reproduce test results. These logs often take one of several forms: network logs (e.g., NetFlow, firewall logs), system logs (e.g., Windows Event Log, Linux Syslogs), or application logs (e.g., Web server access logs, audit logs). The goal of this project is to generate a large dataset combining at least three of these sources by building a test environment, emulating normal behavior, and manually injecting behavior that might be indicative of an insider threat in a real-world environment (with appropriate tracking to ensure these behaviors can be identified in the dataset by other researchers for testing). The will require:

1) determining the types of logs that are to be generated and collected,
2) creating insider threat scenarios of varying degrees of sophistication,
3) building a virtual network for playing out these scenarios amongst a background of normal behavior, while capturing the necessary logs,
4) summarizing the collected data in a manner suitable for sharing with the broader research community.

The project team will need to provide hardware to host the test environment.

Expected Deliverables:

Summary report in IEEE format detailing literature review, methodology, and testing results
Archive of generated dataset and relevant metadata.

Specialized Resources Provided by Client:

Guidance on testbed creation and scenario development

Anticipated Cost: Financial Resources Provided by Client: None

Preferred Students for the Project:

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

Other Special Skills: Experience with virtualization and system administration would be 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
  ☐ In person, ☐ Over the phone, ☐ Web / video conferencing

Meeting ABET Criteria

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

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

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

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

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

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

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

Project Approval – for use by ECpE Senior Design Committee

☑ Approved:  sddec19-proj003
☐ Project Assigned:
☐ Advisor(s) Assigned:
### Project Abstract:

DNA-containing entities (microbes, insects, weed seeds, fungus, etc), both beneficial and detrimental, co-exist in all soil. Knowing what DNA-containing entities exist and their quantity within a soil sample could provide important insight into yield and disease potential across a field. At Solum, we are working to create an inexpensive, automated DNA extraction method to offer fast, reliable quantification tests to farmers. Pest quantification across a farm/field would empower a farmer to treat only areas in which a response to pesticides would occur. This ability would have profound impact on sustainable future farming practices. To extract DNA from all soil DNA-containing entities, there are five basic steps: 1.) cell lysis, 2.) humic acid/cell debris/protein removal, 3.) DNA precipitation, 4.) precipitated DNA washing, and finally 5.) DNA elution. Each step varies in time to completion. The most labor and time-intensive step in DNA extraction is the washing step which removes impurities with an alcohol solution and then the DNA is dried by evaporation. The washing/drying step incorporates nearly 2/3 the total time for DNA extraction. The purpose of this project would be to design and implement an automated method to improve the overall DNA washing/drying step to decrease overall DNA extraction time in a production lab setting.

#### Goals:

1. Improve DNA washing/drying step overall time from 2.5 hours to under 30 minutes.
2. Method must adhere to Solum current production lab capabilities.

#### Design constraints:

1. DNA needs to be bound to a matrix using chemicals.
2. Washing must be gentle so as not to dislodge DNA from matrix.
3. Drying must not introduce contamination.
4. Drying must be complete, as defined as all ethanol evaporated.

#### Expected Deliverables:

The deliverable would be an effective DNA washing technique that is 1.) automated, and 2.) efficient to reduce overall DNA washing and drying step from 2.5 hours to under 30 min.

#### Potential Schedule:

**Week 1:** Learn about DNA and DNA extractions. Learn about Solum and basic sample flow in a soil production lab. This week would also be used to brainstorm washing techniques.

**Weeks 2-6:** Develop and design a washing technique that effectively washes away DNA contaminants without dislodging DNA. This step will be assisted by our molecular biologist with nearly 20 years of experience.

**Weeks 7-10:** Develop and design a drying technique to remove all washing ethanol solution from the DNA.

**Weeks 11-12:** Streamline process and test varying soil types that vary with humic acid concentration.

### Specialized Resources Provided by Client:

Expertise offered at Solum: a software engineer, automation engineers, soil scientists and a molecular biologist.
Senior Design Project Proposal Form

Anticipated Cost: ____________________________  Financial Resources Provided by Client: ____________________________

Hardware needed to build any specialized equipment to complete the deliverable.

Preferred Students for the Project:

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

Other Special Skills:

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

Anticipated Client Interaction (estimate):

☑ 1 meeting per week

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

☐ 1 meeting per month

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

☐ 2 or more meetings per month

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

☐ 1 meeting per semester

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

Meeting ABET Criteria

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

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

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

☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

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

☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

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

☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

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

☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

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

☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4
Project Approval – for use by ECpE Senior Design Committee

☑ Approved: sddec19-proj004

☐ Project Assigned: 

☐ Advisor(s) Assigned: 

Client/Company/Organization: Solum Labs/Land O'Lakes

Submitter Name: Mark Harmison
Email: mharmison@landolakes.com

Project Contact: Mark Harmison
Email: mharmison@landolakes.com

Project Title:
No-Wait Nitrate Machine

Project Abstract:
Solum Labs developed a field-deployable system for measuring nitrate levels in agricultural soil samples. This system includes a hardware device that mixes the soil sample with water to form a slurry, then pushes the slurry through a filter and past a spectrometer where absorption of light is used to measure the nitrated concentration.

The goal of this project is to design and document a robust architecture for the software and firmware to run this system and to develop at least a skeletal implementation that demonstrates the design. The implementation should include automated testing.

The existing hardware system should be considered a design constraint (i.e. we aren’t going to redesign the hardware right now). Since this system will be used in a product Solum Labs sells or leases, any software used in this project must be licensed appropriately (open-source or commercial licenses must be clearly understood).

Expected Deliverables:
- Project plan
- System architecture and design document
- Plan for automated testing
- Skeletal implementation with tests

Approximate schedule:
Feb 1 – Project plan complete and reviewed.
Feb 15 – System architecture and design document – checkpoint 1
Mar 1 - System architecture and design document – checkpoint 2
Mar 15 – Plan for automated testing – checkpoint 1
Apr 1 - System architecture and design document – complete
Apr 15 – Plan for automated testing - complete
May 1 – Skeletal implementation with tests – demonstration and review

Specialized Resources Provided by Client:
Solum Labs will provide one No-Wait Nitrate system to be installed on campus and train the project team on its safe and proper operation.

Solum Labs will provide portions of the existing source code and documentation to assist in understanding hardware/software interfaces.
Anticipated Cost: ___________________ Financial Resources Provided by Client: ___________________

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

Other Special Skills: Project will require a range of 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:

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

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

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

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

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

At this point Solum Labs does not know of any required financial resources for this project. If small license fees or other incidental expenses are required we will address those as they come up.
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:  

sddec19-proj005
Project Title: Open-Source Wireless Innovation Lab for Smart Ag, AR/VR and Beyond

Project Abstract:
Wireless communication is a basic enabler for Internet-of-Things (IoT) and Cyber-Physical Systems (CPS) such as those in smart ag, connected autonomous vehicles, smart grid, Industry 4.0, and AR/VR. Despite over a century of practice in wireless systems, we are still at the infancy of IoT/CPS wireless networking, and there exist ample opportunities to lead the evolution of IoT/CPS wireless networking solutions and their applications. To enable imagining, learning, prototyping, and applying transformative wireless solutions, we will develop and deploy the CyWi open-source wireless innovation lab. The CyWi lab will feature bleeding-edge wireless innovation platforms as well as emerging wireless solutions, and it is expected to enable innovative learning, teaching, and research in 5G wireless and beyond.

Through this project, students will have the opportunity to learn about 5G and advanced wireless, to build an at-scale wireless system (i.e., the CyWi lab itself) that will serve as a lasting infrastructure for ISU and local industry, and to develop innovative wireless solutions. Students will also have the opportunity to work in a team and with graduate students, Prof. Hongwei Zhang, and industry partners. Information about Prof. Zhang’s work can be found at http://www.ece.iastate.edu/~hongwei/.

Expected Deliverables:
A tentative project roadmap is as follows (which is open for revision by the project team):
* January-February 2019: study of IoT/CPS wireless, survey of IoT/CPS wireless platforms,
* March, 2019: initial design of the CyWi lab (e.g., wireless innovation platforms, CyWi software system architecture, CyWi deployment plan etc)
* April, 2019: design refinement and initial development of CyWi lab
* August - November, 2019: development and deployment of CyWi lab
* December, 2019: demonstration and report

Specialized Resources Provided by Client:
Hardware and software resources for building the CyWi lab (including but not limited to IoT/CPS wireless platforms), IoT/CPS wireless algorithms

Anticipated Cost: ___________________________ Financial Resources Provided by Client: Research fund to support the project (e.g., equipment, personnel)
Preferred Students for the Project:
☑ Electrical Engineering
☑ Computer Engineering
☑ Software Engineering
☐ Other:

Other Special Skills: Knowledge of wireless communication/networking, C, C++, web programming; willingness to learn; teamwork.

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

Meeting ABET Criteria

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

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

Project Approval – for use by ECpE Senior Design Committee

☑ Approved: sddec19-proj006
☐ Project Assigned: 
☐ Advisor(s) Assigned: 

Project Title: GoMe: A Life Improvement App

Project Abstract:

Purpose:
GoMe will be an application that looks to better the users life by understanding what the user has done throughout the day. It will take passive input from the various activities and tasks the user has done throughout the day (e.g. sleeping, working out, free time, social events, etc.) by tracking location. The app will then use A.I. to give comprehensive feedback to the user to help them understand what parts of their life need improvements and what they are excelling in. This app also sets out to help users complete tasks on time, reach goals and motivate them to become a better, more productive person. When someone downloads this app, they will be taking the first step of becoming the best version of themselves.

Using data gathered from people everyday activities, GoMe will be able to build a user specific “ideal day” and give real time goals and recommendations for any aspect of your life (professional, recreation, health, etc.).

This is a student-proposed project.

Goals/ design constraints:

Easy to use
Good looking UI
Fun
Interactive with you friends in productive ways and stop wasting your time on other social media
Gives you a blueprint to how to live your life
Gives you feedback and motivation

Technical Approaches:
Android, iOS, firebase database
facebook authentication
Tensor flow or other machine learning framework

Track location and gather other data to understand how the user is spending their time through the use of APIs from things like:
FitBit
GooglePlaces API
Facebook Events
Xbox
Etc... just get a good picture of how user is spending time

Once we have collected the data, create and update a model of the user using A.I. to understand what they like,
habits, weaknesses, strengths, etc.

Expected Deliverables:

Android App:
This schedule is based on having 1 semester to complete this:
3 Weeks: Accurately tracking users activity- where they have been and how they are spending their time.
3 Weeks: A.I. analysis of the users activity data
2 Weeks: Giving the user feedback with the analysis- ideal schedule, what they've done that, analysis of time spent (time breakdown, habits, weaknesses, strengths)
3 weeks social media aspects: leveling up, leaderboards, personalized feed, sharing events, chat
1 week: UI improvements
4 weeks: testing and improvements based on client feedback

Expected Features:

1. Ideal Schedule for User’s Day
   Life can be confusing sometimes. It's hard to know exactly how to use your time. This schedule aims to clear up any misunderstanding a user may have about what they should do throughout the day. This schedule will guide you on the path of reaching your goals while also helping you live a balanced and healthy lifestyle. The data provided to this schedule will come from the individual’s data profile as well as information from what is going on around them (other users activity, traffic, etc., resources available to user) to ensure they are being as efficient as possible. If something happens that impacts the users ideal schedule, the schedule will update. For example, let’s say the app notices that the user is going to a different town for the day, it will access new ways for the user to be productive and then create a new schedule.

2. Users Actual Schedule
   This schedule will be created by tracking the users location (where they’ve been, what they’ve been doing) and displaying to the user what they actually did. There will also be an efficiency rating given to the user and where they fell short and excelled. All in all this information will give the user advice in to help them avoid making the same mistakes in the future and help them repeat the same successes. This data will also be sent to the user profile to help the AI understand more about the user.

3. Personalized Feed
   With everything going on around the world today, it is hard to keep track of all the stuff you’d like to easily. The main goal of the feed of this app is to do just that -- present all of the information about the world that the user might be interested in almost simultaneously. With the app knowing all the things you like or care about, the AI will be able to determine things going on around the world that the user would like to know about and put that at the top of their feed. This feed will also display important updates from around town so you can know about things that might affect their day. The user's friends achievements will also be highlighted in this feed.

4. Traits/ Habits
   On the users profile page, there will be some things displayed to the user. One of those things will be the habits of the user. These habits and traits will be found from the assessment of the data.

5. Time Breakdown
   Another thing to be located on the user's profile is a report of how the user spends their time. Categories could be
the following: Sleep, Workout, Social, Shopping, Relaxation, Work, School, etc. It could also be sorted by day, week, month, year, all time.

6. Daily Recap
At the end of the day the user will receive a recap of the day at a time the user specifies. This will show some of the most important things that went on in the day as far as news around town and the world, as well as any important things their friends did. It will also show the best thing they did that day and how they can prepare for tomorrow.

7. Motivation
Days get get long, especially when you have a day full of difficult tasks you have to accomplish. Well this app will try to motivate the user through several ways:
Making life a game
Users will be rewarded for doing things like accomplishing tasks, going to events, helping friends, how productive they were throughout the day, etc with XP.
When the user gets enough XP they will level up.
Rewards, statuses (like professional or expert), posts celebrating achievement, leaderboards, bragging rights.
Motivational Messages from App
In the feed or through the use of alerts, give the user a fun, motivational message that boosts their spirits
Goals
Create a list of goals for the user to accomplish throughout the day (user gains XP for these).

8. Advice
If the app notices something that the user could quickly correct in order to make sure they reach a goal, schedule item, or task, quickly alert the user so they can make the adjustment.

9. Alerts
Alerts sent to user whenever something important and urgent comes up.

10. Recommendations
With all of the information that we have of the user, we will be able to recommend just about anything to the user. Some examples of recommendations are:
Friends
People/Places
Things that can help them accomplish tasks
Things that can help them reach goals
Sales at stores
Stores with things they need
Prioritized task list
Events

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: Android, Firebase, AI experience would be nice

Anticipated Client Interaction (estimate):

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

Meeting ABET Criteria

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

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

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

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☑ 4

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

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☑ 4

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

☐ 0 ☐ 1 ☑ 2 ☐ 3 ☐ 4

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

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☑ 4

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

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☑ 4

Project Approval – for use by ECpE Senior Design Committee

☑ Approved: sddec19-proj007
☐ Project Assigned: 
☐ Advisor(s) Assigned:
Client/Company/Organization: Farrell’s eXtreme Bodyshaping

Submitter Name: Nathan Schaffer Email: Nathans@iastate.edu

Project Contact: Lance Farrell Email: lancefarrell@extremebodyshaping.com

Project Title: Instructor Certification Website

Project Abstract:
There are many redundant and time-consuming tasks that exist in Farrell’s eXtreme Bodyshaping instructor certification process. Many of these tasks can be eliminated through the creation of an automated system.

This project is to develop a web-based system to automate and streamline the tracking of the Farrell’s Instructor workshop requirements.

Expected Deliverables:
Midpoint and final presentations.
A web-based instructor certification process to help automate simple tasks.

Specialized Resources Provided by Client:
Farrell’s eXtreme Bodyshaping staff will be available to assist the team at all stages of the project. AWS resources will be provided.

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

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

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

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

<table>
<thead>
<tr>
<th>Statement</th>
<th>Rating 0</th>
<th>Rating 1</th>
<th>Rating 2</th>
<th>Rating 3</th>
<th>Rating 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>On this project, students will need to apply knowledge of mathematics, science, and engineering</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>This project gives students an opportunity to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>This project involves students from a variety of programs, i.e., CprE, EE, and SE</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>This project requires students to identify, formulate, and solve engineering problems</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>This project gives students an opportunity to use the techniques, skills, and modern engineering tools necessary for engineering practice</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
</tbody>
</table>

Project Approval – for use by ECpE Senior Design Committee

☑ Approved:  sddec19-proj008
☐ Project Assigned:  
☐ Advisor(s) Assigned:  
Senior Design Project Proposal Form

Client/Company/Organization: ________________________________________________

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

Project Contact: ______________________________________________________________

Email: _____________________________________________________________________

Project Title: Road Safe Phone Case

Project Abstract:

Project Goal: To design and create a restrictive phone case for use in vehicles. The purpose of the phone case would be to ensure that drivers are not using/looking at their phones while driving.

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

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

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

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

Expected Deliverables:

Students should complete a working sample of the phone case by Dec 2019

Specialized Resources Provided by Client:

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

Preferred Students for the Project:

☑ Electrical Engineering

Other Special Skills: Computer/software expertise necessary to
Senior Design Project Proposal Form

☑ Computer Engineering
☑ Software Engineering
☐ Other:

design a case that is able to recognize the contents such that the case allows access only when appropriate contents are placed in the designated side.

Anticipated Client Interaction (estimate):

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

Meeting ABET Criteria

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

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

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

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

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

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

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

Project Approval – for use by ECpE Senior Design Committee

☑ Approved:    sddec19-proj009
☐ Project Assigned:   
☐ Advisor(s) Assigned:   

Project Approval – for use by ECpE Senior Design Committee
Client/Company/Organization: Ajjarapu

Submitter Name: Ajjarapu Email: vajjarap@iastate.edu

Project Title: Design and Implementation of a small scale stand alone Hybrid Solar PV and Wind Energy Generation system for EE 452 lab

Project Abstract:
Renewable energy is getting a lot of attention due to scarcity and bad environmental impact of conventional sources of energy. Wind and solar PV energy are two leading sources of clean energy. Goal of the project is to design and develop a standalone hybrid renewable energy generation system which will consist of wind and solar PV energy. The project will be divided into two parts i.e. software simulation and hardware implementation. For simulations, Simulink-MATLAB will be used following modeling and design aspect will be included:
1. Design and modeling of solar PV panel and maximum power point tracking (MPPT) algorithm using electronic converters.
2. Design and modeling of voltage inverter and its switching mechanism to convert solar DC power to AC.
3. Wind energy generation system
4. Loads, battery bank and their integration to the energy generation system.
5. Integration of Solar PV and wind energy generation system and maintaining power quality of power supply.

After simulation results, a prototype hardware system will be designed and developed in the laboratory. Following aspects will be there in hardware design:
1. Solar panels, voltage inverter and batteries are available. MPPT and other control techniques will be implemented through D-Space real time controller.
2. Wind sensors are available in the lab to measure wind speed and imitate wind turbine to generate energy.
3. Finally, Solar PV and wind will be combined with load and battery bank.

Expected Deliverables:
A real-time demonstration of solar and wind energy generation system; 2.) An experiment design for EE452 lab course

Specialized Resources Provided by Client:
Solar panels, Inverter, batteries, wind sensors

Anticipated Cost: Financial Resources Provided by Client: ________________

Preferred Students for the Project:
☑ Electrical Engineering
☑ Computer Engineering
☐ Software Engineering
☐ Other: Other Special Skills: matlab, some hardware design, power 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:

| 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: sddec19-proj010
☐ Project Assigned: ____________________________
☐ Advisor(s) Assigned: ____________________________
**Client/Company/Organization:** SunCrate dba as King of Trails Construction

**Submitter Name:** Anne Kimber  
**Email:** akimber@iastate.edu

**Project Contact:** Dolf Ivener  
**Email:** dolfivener@gmail.com

**Project Title:**
Technical and economic comparisons of solar-with-storage packages for residential and commercial application

**Project Abstract:**
In this project students will work with SunCrate, an Iowa developer of stationary and mobile solar-with-storage solutions for residential, commercial and agricultural customers, to evaluate the claims versus the actual technical capabilities of these commercial packages. The students will evaluate solar array output, inverter capabilities and battery storage options separately, and as packages, from up to 8 manufacturer combinations. They will evaluate the performance potential to gain understanding of performance metrics and guarantees, including providing economic analyses of the costs and benefits of various combinations, for different customer load profiles.

This information will be documented and posted so that other solar professionals and manufacturers can use this information to best help their customers.

**Expected Deliverables:**
Spreadsheet tool and final report on comparisons of up to 8 commercial packages of solar, inverter and storage options for residential and commercial applications, including critiques of operating limitations for each technology

**Specialized Resources Provided by Client:**
The client will select the technologies and provide expertise on installation histories, and challenges that developers/installers commonly encounter with these technologies.

**Anticipated Cost:**

**Financial Resources Provided by Client:**

**Preferred Students for the Project:**

- [☑] Electrical Engineering
- [☐] Computer Engineering
- [☐] Software Engineering
- [☐] Other: interest in renewable energy and distribution engineering, EE 303 and 455, and if possible some background in calculating cost benefit ratios

**Anticipated Client Interaction (estimate):**

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

Meeting ABET Criteria

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

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

Project Approval – for use by ECpE Senior Design Committee

☑ Approved: sddec19-proj011
☐ Project Assigned: 
☐ Advisor(s) Assigned: 
Client/Company/Organization: Meng Lu/ECpE/ISU

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

Project Title: Rapid detection of Fentanyl using a multifunction nanostructured substrate

Project Abstract:
As a synthetic opioid, fentanyl has become the most common drug involved in drug overdoses. According to the US CDC, the rate of drug overdoses involving the fentanyl raised about 113% each year from 2013 to 2016 and resulted in over 10,000 overdose deaths in 2016. Fentanyl is often mixed with heroin or cocaine without user knowledge. To prevent the overdose of fentanyl, there is an urgent need to detect fentanyl in a mixture of chemicals. The SD project will investigate a novel photonic sensor to separate and quantify fentanyl. The multifunction fentanyl sensor will be designed, fabricated, and characterized during the 1 year period of this SD project.

Expected Deliverables:
1. Design of the nanophotonic fentanyl sensor; 2. Fabrication process for the proposed fentanyl sensor; 3. Results of fentanyl detection using the fabricated sensor.

Specialized Resources Provided by Client:
Imprint lithography machine, e-beam evaporator, optical spectrometers

Anticipated Cost: Financial Resources Provided by Client: ~ $2,000

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

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

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

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

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

☐ 0 □ 1 □ 2 □ 3 ☑ 4

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

☐ 0 □ 1 □ 2 □ 3 ☑ 4

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

☐ 0 □ 1 ☑ 2 □ 3 □ 4

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

☐ 0 □ 1 □ 2 □ 3 ☑ 4

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

☐ 0 □ 1 □ 2 □ 3 ☑ 4

Project Approval – for use by ECpE Senior Design Committee

☑ Approved: sddc19-proj012

☐ Project Assigned:

☐ Advisor(s) Assigned:
Client/Company/Organization: Iowa Army National Guard

Submitter Name: Anne Kimber Email: akimber@iastate.edu

Project Contact: Ken Thornton Email: ken.o.thornton.nfg@mail.mil

Project Title:
EMP hardening for distributed generation and storage as part of energy planning at the National Guard Camp Dodge facility

Project Abstract:
In this project students will work with the Iowa Army National Guard as the Guard incorporates a new solar-with-storage mobile power source that will be "microgrid-ready" as a plug-and-play system at Camp Dodge. The students will participate in design meetings for the project, and they will be primarily responsible for researching, evaluating and suggesting solutions for ElectroMagnetic Pulse hardening of the power source and microgrid connections, and other EMP challenges as indicated by Mr. Thornton, the IANG contact. As the mobile power source project is constructed and deployed the students will participate in developing online course materials (written, video and narration) that describe the engineering features of the microgrid and they will participate in the testing and commissioning of the power source. They will be expected to understand all features of this power supply resource and its integration into Camp Dodge’s distribution system.

Expected Deliverables:
Deliverables: EMP hardening recommendations for the mobile power crate and other facilities at Camp Dodge, reports, videos and tutorial materials on the design features of the mobile power crate

Specialized Resources Provided by Client:
The client will provide information on the EMP hardening military requirements, and will provide information on the mobile power crate and distribution system.

Anticipated Cost: 100

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

Other Special Skills: interest in renewable energy and distribution engineering, EE 303 and 455, and if possible some background in calculating cost benefit ratios

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

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

☐ Approved:   sddec19-proj013

☐ Project Assigned:  

☐ Advisor(s) Assigned:  

Client/Company/Organization: City of Bloomfield

Submitter Name: Chris Ball  
Email: chris.ball@cityofbloomfield.org

Project Contact: Danny Simonson  
Email: danny.simonson@cityofbloomfield.org

Project Title: Electric Distribution System Inventory and Inspection using Drone Deployed Remote Sensing Technology

Project Abstract: Inventoring and inspecting electric distribution systems requires significant time and resources. Is there a way that the system could be inventoried and inspected using remote sensing and a drone?

The team will work with the City of Bloomfield to build a drone, or adapt an existing drone, specifically to observe and capture inventory and system specifications of overhead electric distribution infrastructure. System information will be imported into a model in OpenDSS, of the City's power system. The drone will be tested in Bloomfield. The project will be conducted in the spring and fall semesters of 2019.

It is anticipated that the drone will capture:
* primary conductor specifications
* secondary conductor specifications
* pole and attachment specifications
* inline transformer specifications
* GPS locations of assets
* deficiencies indicated by thermal imaging

The city of Bloomfield is the county seat of Davis County, in southeast Iowa. The city operates municipal electric, gas, water and wastewater treatment systems, and serves about 2,640 residents. The electric utility is studying options for energy independence, has participated in the Rocky Mountain Institute eLab Accelerator program, and is a member of the ISU Electric Power Research Center.

Expected Deliverables:
* Geo-located asset inventory of Bloomfield's electric distribution system - May 2019
* Identification of system deficiencies detected via thermal imaging - May 2019
* Model of Bloomfield's electric distribution system in OpenDSS - December 2019

Specialized Resources Provided by Client:
* Model of distribution system inventory database
* GPS locations and inspection data of utility poles
* GPS inventory of electric meters

Anticipated Cost:  
Financial Resources Provided by Client: 
Senior Design Project Proposal Form

Preferred Students for the Project:

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

Other Special Skills:

Anticipated Client Interaction (estimate):

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

Meeting ABET Criteria

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

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

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

☐ 0   ☐ 1   ☐ 2   ☐ 3   ☑ 4

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

☐ 0   ☐ 1   ☐ 2   ☐ 3   ☑ 4

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

☐ 0   ☐ 1   ☐ 2   ☐ 3   ☑ 4

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

☐ 0   ☐ 1   ☐ 2   ☐ 3   ☑ 4

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

☐ 0   ☐ 1   ☐ 2   ☐ 3   ☑ 4

Project Approval – for use by ECpE Senior Design Committee

☑ Approved: sddec19-proj014
☐ Project Assigned: 
☐ Advisor(s) Assigned: 
Senior Design Project Proposal Form
Senior Design Project Proposal Form

Client/Company/Organization: Collins Aerospace

Submitter Name: Katie Knott Email: kathleen.knott@collins.com

Project Contact: Jason Wong Email: jason.wong@collins.com

Project Title: Artificially Intelligent Requirement Analysis Tool

Project Abstract:

United Technologies’ planned acquisition of Rockwell Collins has formally closed to create a new leader in the industry — Collins Aerospace, which brings together the complementary capabilities of Rockwell Collins and UTC Aerospace Systems.

We have the capability, intelligent solutions and industry relationships to meet the demands of an evolving global market and growing workforce. With one of the most technologically advanced and comprehensive portfolios in aerospace, Collins Aerospace is ready to make its mark in the industry.

The Military Avionics and Helicopters department at Collins Aerospace is looking for a group of students interested in the fields of artificial intelligence and human machine interaction. Due to the nature of our safety and mission critical systems, we are looking to have a group of students design and develop a tool to improve the quality of our software development process. Specifically, the tool will aid in analyzing the correctness of software and system requirement tracing using deep learning, natural language processing, etc.

A "requirement" is a clear description of a particular capability or functionality of a product. "Requirements tracing" is the practice of creating logical "links" between individual requirements. For example, a functional software requirement may trace to a higher-level architecture or system requirement. You may also trace a functional software requirement to the source code and test that were created in result of the requirement. The problem is that the products developed at Collins Aerospace involve thousands upon thousands of requirements and requirement links, and review of the requirements links is mostly done by hand. The main purpose of the tool is to output a report detailing the correctness of a requirements trace. Interaction with the tool should be done through a clean, user-friendly interface. The tool will most likely be developed in Python or a comparable programming language.

Expected Deliverables:

Expected schedule- First semester: initial research, design, and prototype development. Second semester- final development and testing.
Expected deliverables- the source code for the tool, executable for the tool, documentation to assist further development, test results

Specialized Resources Provided by Client:

Requirements Data
Machine Learning Computing Hardware

Anticipated Cost: __________________________ Financial Resources Provided by Client: __________________________

Preferred Students for the Project:
Senior Design Project Proposal Form

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

**Other Special Skills:** Deep Learning, Natural Language Processing, Python, Requirements Tracing (or the willingness to learn above 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:

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

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

☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

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

☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

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

☐ 0  ☐ 1  ☐ 2  ☑ 3  ☐ 4

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

☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

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

☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

---

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

☑ Approved: sddec19-proj015

☐ Project Assigned:

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

Submitter Name:  Katie Knott  Email:  kathleen.knott@collins.com

Project Contact:  Andy Zobro  Email:  andy.zobro@collins.com

Project Title:

Finding Hay in the Needle Stack: Big Data, and Doing the Right Thing at the Right Time

Project Abstract:

United Technologies’ planned acquisition of Rockwell Collins has formally closed to create a new leader in the industry — Collins Aerospace, which brings together the complementary capabilities of Rockwell Collins and UTC Aerospace Systems.

We have the capability, intelligent solutions and industry relationships to meet the demands of an evolving global market and growing workforce. With one of the most technologically advanced and comprehensive portfolios in aerospace, Collins Aerospace is ready to make its mark in the industry.

Collins Aerospace, a global has multiple software products that it must rigorously test, ranging from the brains behind guidance and navigation functions to 4D pathfinding software that helps avoid moving and static obstacles. Some in-house tools generate and store results for every single test ran against against the software; one test can have thousands of runs but multiplied over thousands of tests, this means tens of millions of test results. How can these results be interpreted? Is the test written incorrectly? Does the software have a hidden bug? Why is program A's test different than program B's, when they are both testing the same piece of software? Is the software truly not meeting requirements? With such a sheer amount of data, the right analyses can result in insights that would otherwise not be obvious, and equip engineers with what they need to more effectively deliver a high-quality product.

Using a development methodology of their choosing, students will design, implement, test, and deliver a software product that visualizes data and provides insights to Collins Aerospace engineers as they go about software development and testing. The software deliverable will be expandable, change-accommodating, and will interface with an internal tool: "Software Test Archive and Reporting With user Authentication and Registration Support" or STARWARS for short. Expect to use Python, SQL, big data analysis techniques, and software design principles throughout the project.

Expected Deliverables:

Source code of a tool that can assimilate and visualize data, and develop signatures for tests. Summary of design and new functions.

Specialized Resources Provided by Client:

Obfuscated test results data

Anticipated Cost:  

Financial Resources Provided by Client:  

Preferred Students for the Project:

☐ Electrical Engineering  ☑ Computer Engineering  

Other Special Skills: Python and SQL skills are strongly recommended.
Software Engineering
☑ Other:
Data analysis techniques are recommended.

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

Meeting ABET Criteria

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

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

Project Approval – for use by ECpE Senior Design Committee

☑ Approved: sddec19-proj016
☐ Project Assigned:
☐ Advisor(s) Assigned:
United Technologies’ planned acquisition of Rockwell Collins has formally closed to create a new leader in the industry — Collins Aerospace, which brings together the complementary capabilities of Rockwell Collins and UTC Aerospace Systems.

We have the capability, intelligent solutions and industry relationships to meet the demands of an evolving global market and growing workforce. With one of the most technologically advanced and comprehensive portfolios in aerospace, Collins Aerospace is ready to make its mark in the industry.

**Product Track Roadmap And Contracts - Electronic Repository (TRACkER) Tool**

Develop tool to track product roadmap information across the organization, including items such as contracts information and product lifecycle status.

Process will be 1) requirements capture, 2) design, 3) development, and 4) test of a product tracker tool. Provide some supporting documentation around design specifics (valid value ranges, data types, etc).

Initial thoughts (can be revised by team) is that this would be a web-based tool accessible to enterprise (could be added to company intranet). Need capability to input data from various sources; display and export data that meets user-entered criteria.

**Expected Deliverables:**
The product tracker tool and supporting documentation.

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

Project Approval – for use by ECpE Senior Design Committee

☑ Approved: sddec19-proj017
☐ Project Assigned: 
☐ Advisor(s) Assigned: 
Client/Company/Organization: MakuSafe Corp
Submitter Name: Chris Wagner Email: chris@makusafe.com
Project Title: Bluetooth Mesh Network for Industrial Wearable Technology

Project Abstract:
Project goal: Successfully send sensor data from a bluetooth low-energy (BLE) wearable device (see details on wearable) through a dynamic mesh network of other BLE wearable devices to a base station (see details on base station) to demonstrate the implementation of a BLE mesh network for worker safety in industrial settings.

Wearable: MakuSafe has an existing proprietary wearable device that collects motion and environmental data. This device communicates over wifi and uses a proprietary firmware stack. For the purposes of this project, the wearable device could be an off-the-shelf device like the TI SensorTag or a device designed and developed by students. Real world sensor data is not critical for the demonstration of this project.

Base Station: MakuSafe has an existing base station that works as an "edge device" within their system topology. The base station uses a RaspberryPi 3B single board computer at its core. The project could also leverage the RaspberryPi platform as an edge device to collect wearable sensor data using custom software developed by students.

A successful project would demonstrate the transmission of sensor data through a BLE mesh network of wearable devices to the base station. It would support reliability, tolerance to disruptions such as delays in sending data when a wearable is out of range of the mesh network and optimized paths through the mesh network.

*** See attached flyer and our website for company info, 2min intro video https://youtu.be/wXcgMJz4LoI
Recent Des Moines Register Article with slideshow and video:

Expected Deliverables:
The deliverable should include a reference architecture describing the implementation of the BLE mesh network. In addition, all successfully implemented software and firmware code. This reference architecture should be suitable for MakuSafe to apply the same principles to its proprietary hardware and software solutions. This should be delivered at the end of the project.

Specialized Resources Provided by Client:

Anticipated Cost: Financial Resources Provided by Client:

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

### Course Selection
- [☑] Computer Engineering
- [☑] Software Engineering
- [☐] Other: **Hardware Radios (BLE)**
- [☐] Software 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

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

### Project Approval – for use by ECpE Senior Design Committee
- [☑] Approved: **sddec19-proj018**
- [☐] Project Assigned: ____________________________
- [☐] Advisor(s) Assigned: ____________________________
Client/Company/Organization: Dr. Tom Daniels

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

Project Contact: 
Email: 

Project Title: Learning Holiday Light Project

Project Abstract:
The team will continue the prior Holiday light project. The goals are to learn through an interactive procedure, the locations of lights on a tree or other structure and then allow for user-created patterns to be animated around the structure.

Expected Deliverables:
Hardware and software to run the lights and learn the positions of lights.

Specialized Resources Provided by Client:
Hardware is mostly in place.

Anticipated Cost: Financial Resources Provided by Client: None

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

Other Special Skills: Mostly

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, ☐ 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.

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.

<table>
<thead>
<tr>
<th>Project Approval – for use by ECpE Senior Design Committee</th>
</tr>
</thead>
<tbody>
<tr>
<td>☑  Approved:</td>
</tr>
<tr>
<td>sddec19-proj019</td>
</tr>
<tr>
<td>☐  Project Assigned:</td>
</tr>
<tr>
<td>☐  Advisor(s) Assigned:</td>
</tr>
</tbody>
</table>
Client/Company/Organization: Buildertrend

Submitter Name: Kirit Chandran Email: kirit.chandran@buildertrend.com

Project Contact: Email: 

Project Title: Companion file browser application for the Buildertrend web-application for Windows

Project Abstract:
Buildertrend currently has a companion windows application that users can install on their local machine that allows a user to edit files locally. This project is to expand the functionality of this current companion application to include a file browser and file sync capabilities where users can drag and drop files to sync to the web-application. In addition this project will also require creation of a web application to interface with the companion app. Design constraints: Be consistent with the existing patterns implemented in the current companion application. Technologies used: Winforms, SignalR, WebAPI, Web-application (react)

Expected Deliverables:
Web interface that allows user/file creation. Expanded capabilities of the current windows application to include file browser and file sync capabilities. Detailed requirements will be provided upon request or project selection. Expected delivery Dec 1, 2019.

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: Software development experience in c#. Note: Buildertrend requests only students who have NOT worked for them in the past.

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

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

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

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

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

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

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

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

---

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

☑ Approved: sddec19-proj020

☐ Project Assigned: ________________________________

☐ Advisor(s) Assigned: ________________________________
Client/Company/Organization: iowa State University Music Program

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

Project Contact: Tin-Shi Tam Email: tstam@iastate.edu

Project Title: Campanile-Carillon Model Phase II

Project Abstract: To develop a 1:5 scale replica of the Iowa State campanile and a 27-bell carillon.

Expected Deliverables:
1. Continue to develop a tutorial "learn how to play the carillon".
2. Design the layout for the display and related components, which will be used as a platform for university and organizations to present related information.

Specialized Resources Provided by Client: 

Anticipated Cost: Financial Resources Provided by Client: 

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

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

Meeting ABET Criteria

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

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

On this project, students will need to apply knowledge of mathematics, ☐ 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.

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: sddec19-proj021
- [□] Project Assigned: 
- [□] Advisor(s) Assigned: 

---
Client/Company/Organization: 

Submitter Name: Trevin Nance
Email: tlnance@iastate.edu

Project Contact: Alexander Stoytchev
Email: alexs@iastate.edu

Project Title: SheetVision

Project Abstract:

The goal of this project is to develop a mobile application which will analyze sheet music using computer vision and play the music notated out loud for the end user. The application will provide an easy to use interface which is capable of converting from sheet music to sound in little time.

We are considering multiple different technologies for implementing this application. These include ReactJS (JS, HTML, CSS, PHP), Electron (JS, HTML, CSS, PHP), Python, OpenCV, AWS. There may be other unaccounted for softwares involved such as drivers for additional cameras used or speakers. The biggest constraint will be the processing power required to quickly analyze and play back the sheet music. For a mobile application this will possibly require the use of Amazon Web Services to keep the workload on mobile devices low. Another constraint will be the quality of sheet music provided, as well as low resolution images.

[This is a student-proposed project]

Expected Deliverables:

User-friendly and responsive user interface
System to read in images of sheet music
Computer vision system used to decode sheet music into information useful for the application
System that uses information provided by the computer vision system to select what notes should be played and when
Music is played

Specialized Resources Provided by Client:

Amazon Rekognition
Price (estimate): ~$5/month x 10 months = $50
https://aws.amazon.com/rekognition/pricing/

Book of sheet music
Price: ~$20

Anticipated Cost: 

Financial Resources Provided by Client: 

Preferred Students for the Project:
Senior Design Project Proposal Form

☐ 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:

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

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

☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

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

☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

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

☐ 0  ☐ 1  ☐ 2  ☑ 3  ☐ 4

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

☐ 0  ☐ 1  ☐ 2  ☑ 3  ☑ 4

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

☐ 0  ☐ 1  ☐ 2  ☑ 3  ☑ 4

Project Approval – for use by ECpE Senior Design Committee

☐ Approved:  sddec19-proj022

☐ 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 Title: User information augmentation. Vision bases information delivery system

Project Abstract:
With technology evolution there are vast amounts of information being available to the user. Such is true for today's agricultural and construction machinery. Operation of the large equipment is getting more and more complicated requiring users to undergo extensive training. A HUD based device that would fuse position sensor readings from camera(s) will significantly increase machine operation safety, reliability and effectiveness.

The intended system design and evaluation for this project should include a front end projection transparent glass screen(s), projector(s), an eye tracking system (like Tobii Eye Tracker 4C), camera system (both visible and thermal like Flir Lepton), GPS, etc all integrated using Nvidia's Jetson TX2 computer.

System shall act similar to HUD type devices installed in commercial vehicles. The software shall fuse sensory information from available sources and display it on the glass projection screen in front of the operator. System shall have the ability to track operators gaze using eye tracking system also.

Expected Deliverables:
Evaluation of front projection systems & eye tracking (1'lst semester), sensory data fusion and active display (2'nd semester)

Specialized Resources Provided by Client:
All necessary hardware, front projection glass screen, projector, cameras, eye tracking device, Nvidia Jetson TX module and etc...

Anticipated Cost: Financial Resources Provided by Client:

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

Other Special Skills: HMI design, image processing, embedded computing, algorithm design and optimization.

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

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

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

Project Approval – for use by ECpE Senior Design Committee

☑ Approved: sddec19-proj023
☐ Project Assigned: ____________________________
☐ Advisor(s) Assigned: ____________________________
Senior Design Project Proposal Form

Client/Company/Organization: Goce Trajcevski, ECpE

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

Project Contact: Email: 

Project Title: 

Enabling Platform for Context-Aware Investigation of Empathic Behavior in Education

Project Abstract:

The paradigm of Empathic Computing focuses on designing systems for understanding human states and feelings, made possible by the convergence of affordable sensors, embedded processors and wireless networks. However, the data gathered by different monitoring devices needs to be subsequently: (1) analyzed at larger scale, in order to have an impactful decision-making process; (2) Used to balance/prioritize the resources that affect the subsequent data gathering processes.

The main purpose of this project is to develop an architecture/environment that will enable an improvement of the overall quality of the education for University student. Towards that, the system should be able to capture (and integrate) several contexts like, for example: location (i.e., classroom); time (i.e., time-of-day; day-in-week; ...); course and topic lectured; web-traffic in the immediate_before, during and immediate_after time periods; semantics of the web-traffic (e.g., topics of text messages; tweets; ...). Based on the data from the different contexts, learning algorithms can be invoked to predict the state of the participants (students, in this case) in subsequent instances, as well as to generate recommendation for improving the overall experience (e.g., by influencing the lecture/presentation style).

Expected Deliverables:

Upon the completion of 491, the students are expected to have a completed design of the overall system, along with a (subset of) use-case testing. In more details, the milestones for 491 are:
1. Week #4: finish literature overview and define the scope/requirements spec.s;

2. Week #6: complete the market-study and decide upon devices/platforms to be used for the subsequent developments;

3. Week #8: finalize the decisions of which scenarios/use-cases will be worked upon, as well as corresponding testing methodologies;

4. Week #12: complete the revisions of the requirements and proceed towards finalizing the design and defining milestones for 492;

The implementation of the completed version should be available at the time of finishing 492.

Specialized Resources Provided by Client:

Anticipated Cost: Financial Resources Provided by Client:

Preferred Students for the Project:
Senior Design Project Proposal Form

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

Other Special Skills:

Anticipated Client Interaction (estimate):

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

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

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

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

Meeting ABET Criteria

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

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

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

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

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

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

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

Project Approval – for use by ECpE Senior Design Committee

☑ Approved: sddec19-proj024

☐ Project Assigned:

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

Client/Company/Organization:  Iowa State University

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

Project Contact:  Randy Geiger  Email:  rlgeiger@iastate.edu

Project Title:  Sound Effect Device for Musicians

Project Abstract:

This project will involve the design and testing of a special 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.

The specific sound effects device that is targeted will depend upon the interests and innovation of the students but two devices that might be considered are:

Device 1:  “Super-tube amplifier”
One electronic device that receives a lot of attention is the “tube amp”. In their natural form, tube amplifiers use vacuum tubes rather than transistors and op amps to build the power amplifiers. Though tubes introduce distortion and are both more expensive and less reliable than transistor-based amplifiers, some people think they sound better and actually like the type of distortion that they cause. So the project could take the path of designing a “super-tube” amplifier whereby the goal would be to actually enhance the distortion that makes a tube amp appealing and come up with a type of amplifier using transistors or other solid-state devices that is even more appealing than an actual tube amp.

Device 2:  Looper
One particularly interesting effect is produced by a looper. With a looper, a sample of a signal is recorded and then added back into the real-time signal path in a recirculating manner. For example, a sample 4 seconds long might be recorded and then added back in each 4 seconds until the musician decides to stop the looping. Variants of the looper that automatically grab the looping signal from the beat of the music, that have it fade out, that reverse the order of the looping, that alternately loop forwards and backwards, etc. would be investigated to obtain a new effect device that is hopefully of interest to musicians.

Expected Deliverables:

Design and fabrication of a prototype device along with test results and assessment of interest in the device by musicians that are not a part of the design team. Flexibility on this project is intentionally broad to allow individual creativity and interests to dictate the direction of the project

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: Only students that are interested in exploring their creativity in the audio arena 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 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

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

Project Approval – for use by ECpE Senior Design Committee
- [☑] Approved: sddec19-proj025
- [□] Project Assigned: 
- [□] Advisor(s) Assigned: 
Senior Design Project Proposal Form

Client/Company/Organization: PowerCyber Lab, Iowa State University

Submitter Name: Gelli Ravikumar Email: gelli@iastate.edu

Project Contact: Manimaran Govindarasu Email: gmani@iastate.edu

Project Title: Remotely Controlled Wireless-enabled Smart-Lights Hub Prototype

Project Abstract:

Develop a remotely-controlled wireless-enabled smart-lights hub prototype. It would be carried out through two modules. 1) Implementation of transmitter junction box: It receives multiple switch statuses (open/close), converts to digital packets with unique identifier and payload including the smart-light state, and transmits them to smart light units, and 2) Implementation of wireless-enabled (remotely-controlled) light units: Each unit receives the signals from the transmitter box to keep the smart-light status (ON/OFF). The design includes the efficient IoT data transmission protocol like Zigbee for the communication between the transmitter and receiver. The smart-light units can be powered through rechargeable lithium-ion battery and expected a minimum of 10-12 hrs continuous operation. Each smart-light unit can include a small magnetic strip/disc so that they can provide flexibility to arrange on the magnetic frame/board. PowerCyber lab supports all the required resources for the project. The demonstration of the project includes the transmitter and receiver unit modules and seamless control of wireless-enabled smart-light units.

Expected Deliverables:

1) Transmitter Junction Setup, 2) Wireless-enabled Smart Lights, 3) Software for configuration & management of the Smart Lights, and 4) Technical project report.

Specialized Resources Provided by Client:

Access to PowerCyber Lab, Hardware/software units required to the prototype, and access to final deployment VM.

Anticipated Cost: Financial Resources Provided by Client: Yes

Preferred Students for the Project:

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

Other Special Skills: A prior experience on the electronic circuits, embedded systems and micro-controller programming would help them in the development of the 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
☐ In person, ☐ Over the phone, ☐ Web / video conferencing

Meeting ABET Criteria

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

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

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

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

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

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

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

Project Approval – for use by ECpE Senior Design Committee

☑ Approved: sddec19-proj026
☐ Project Assigned:

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

Client/Company/Organization: Infrastructure and Environmental Systems Support (IESS)

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

Project Contact: rlegeiger@iastate.edu Email: rlegeiger@iastate.edu

Project Title: Goose Chaperone

Project Abstract:
This project will involve the design of a land-based goose shepherding device. Though Geese are majestic birds that are often interesting to watch, they can also be a nuisance. One estimates places damage caused by geese to aviation at the $1 Billion dollar per year level. They are also disruptive in a number of other areas. For example, geese also like to frequent parks, yards, ponds, and golf courses. As a specific example, on a golf course, geese often leave fresh “scat” on greens and pester (or even attack) golfers walking down a fairway. And, when they nest and feed near airports, there are increased chances of being hit by airplanes. There are few ecologically friendly methods of keeping geese out of such places.

This project will focus on the design of a Goose Chaperone that will chaperone geese away from specific land, water, and even ice surfaces. Much like the concept of the Roomba which is a commercial product that vacuums in a particular area, the Goose Chaperone will automatically and autonomously identify geese and chase them away from protected areas. Though standard scare devices such as noise, light, and even “scare crows” are ineffective at deterring geese because they become acclimated to such scare devices, it is believed that the Goose Shepherd which will actually confront a goose but not harm it will be effective at keeping geese out of a protected area.

The land version of the Goose Shepherd will be expected to perform much as a Roomba in that it will be constrained to operate over a limited region (e.g. the greens and/or fairways of a golf course) but it will be different in that it will identify the target and then confront the goose to firmly but harmlessly herd it away from the protected area. With this non-lethal approach, we should be able to keep geese out of critical regions without raising concerns by animal ecology groups. It is envisioned that there could be a large demand for such devices.

Expected Deliverables:
Design and fabrication of a prototype device that can identify and herd geese out of a pre-determined region either on land or on water. Included will be test results that show it is capable of identifying and engaging with the target species.

Specialized Resources Provided by Client:

Anticipated Cost: Up to $400 to help offset prototype development costs. IESS may share proprietary information and will retain intellectual property rights.

Financial Resources Provided by Client:
Senior Design Project Proposal Form

property rights to all innovations resulting from this project.

Preferred Students for the Project:

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

Other Special Skills:

Anticipated Client Interaction (estimate):

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

Meeting ABET Criteria

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

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

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

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

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

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

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

Project Approval – for use by ECpE Senior Design Committee

☑ Approved: sddec19-proj027
☐ Project Assigned: ________________________________

☐ Advisor(s) Assigned: ________________________________
Counterfeit Countermeasures for the Integrated Circuit Supply Chain

Project Abstract:

This project will focus on the development of a counterfeit countermeasure strategy for integrated circuits. There are varying estimates about the number of counterfeit electronic components that are in the standard component supply chain today. 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. Other estimates place the total counterfeit market at between 1% and 2% of total semiconductor sales. Regardless, counterfeiting of integrated circuits is now a multi-billion dollar business. 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, Samsung, 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, a PUF(physically unclonable function) -based 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. To make the authentication circuit attractive to both the semiconductor manufacturers, it must be extremely small, require no additional pins, and have no adverse effect on performance of the desired 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.

This project will include the development of a cloud-referenced data management plan that can be used to interact between the manufacturer and the consumer. Included should be a plan on how it can be structured and the operational cost of maintaining such a system. When fully implemented, it should be able to keep track of every integrated circuit that is manufactured anywhere in the world.

Expected Deliverables:

- Study and report on characteristics of existing weak and strong PUFs. Prototype design of a PUF-based authentication 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.
- Another deliverable will be the design of a cloud-referenced data management plan that is capable of tracking a large number of integrated circuits. It should include a prototype tool that is capable of managing up to 10,000 integrated circuits.
Senior Design Project Proposal Form

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 working on the hardware part of the project should be enrolled in or have completed EE 330 and at least one team member should have completed EE 330. Software Engineering or Computer Engineering background is expected for students working on the cloud-based data management plan.

Anticipated Client Interaction (estimate):

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

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

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

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

Meeting ABET Criteria

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

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

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

☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

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

☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

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

☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

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

☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

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

☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4
Senior Design Project Proposal Form

Project Approval – for use by ECpE Senior Design Committee

☑ Approved: sddec19-proj028

☐ Project Assigned: 

☐ Advisor(s) Assigned: 

________________________________________

________________________________________
Client/Company/Organization: Optical Operations

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

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

Project Title: IoT Elderly Care Solution

Project Abstract:
The goal of this project is to make improvements and advancements of an previous capstone project called Sequoia. Sequoia is predictive health analytics solution that uses a series of sensors to generate an behavioral profile of seniors. Seniors are habitual and tend to do the same things. Using a series of sensors within a home we can identify data trends and correlations that outline a seniors activities. The objective of this project is to determine if the data collected from a series of sensors can help predict or see early signs of health deterioration.

Expected Deliverables:
The expectation of this group is as follows: 1) Redesign a solution for identifying seniors eating habits 2.) From the data, the group needs to be able to identify when and how an senior eats breakfast, lunch, and dinner. 3) The data needs to be displayed on a mobile and web application

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

Anticipated Cost: Financial Resources Provided by Client: All resources will be provided by the Client.

Preferred Students for the Project:
- Electrical Engineering
- Computer Engineering
- " Other Special Skills: Identity and program hardware
- Software Engineering
- Other:

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

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

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

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

☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

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

☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

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

☐ 0  ☐ 1  ☐ 2  ☑ 3  ☐ 4

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

☐ 0  ☐ 1  ☐ 2  ☑ 3  ☐ 4

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

☐ 0  ☐ 1  ☐ 2  ☑ 3  ☑ 4

Project Approval – for use by ECpE Senior Design Committee

☑ Approved:  sddec19-proj029

☐ Project Assigned:  

☐ Advisor(s) Assigned:  

Senior Design Project Proposal Form

Client/Company/Organization:   Iowa State University

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

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

Project Title:  
Printed miniature nutrient sensors

Project Abstract:

The goal of the project is to develop and deploy printed sensors for detection of nutrient in plant, soil and water. The sensors are to be an alternative to conventional nutrient monitoring involving colorimetric analyses in the laboratory. The sensors will be portable to measure various nutrients in agricultural environment. In collaboration with Agronomy Department and Plant Sciences Institute at Iowa State, the team will design, fabricate and characterize the sensors and then deploy them in the greenhouse and field to monitor dynamic changes in nutrients over time as plants grow.

Various new sensor technologies will be evaluated in terms of sensitivity, specificity, reliability, and durability. 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 both 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:

1. Printed nutrient sensors for nitrate, phosphate, and potassium.
2. Wireless sensor circuits
3. APP for nutrient sensors
4. Testing in both greenhouse and crop field

Specialized Resources Provided by Client:

Robotic dispensing system, 3D printer, laser cutting machine, screen printer, nanomaterial printer, sensor materials.

Anticipated Cost:                          Financial Resources Provided by Client:  500

Preferred Students for the Project:

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

Anticipated Client Interaction (estimate):
Meeting ABET Criteria

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

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

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

☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

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

☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

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

☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

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

☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

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

☐ 0  ☐ 1  ☐ 2  ☐ 3  ☑ 4

Project Approval – for use by ECpE Senior Design Committee

☑ Approved:  sddec19-proj030

☐ Project Assigned: 

☐ Advisor(s) Assigned: 

Client/Company/Organization: Iowa State University

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

Project Title: Ultra-thin electronic skin for real-time health Monitoring

Project Abstract:

It’s a rapidly growing space enabling multi-vital sign monitoring capabilities for improving health. We aim at developing an electronic skin technology to monitor health and vital signs such as heart rhythm, respiratory rates, heart rate variability, electrocardiogram, temperature, and vocalization. These sensors resemble Band-Aids in that they conform to the natural shape of the human body. They can be snugly placed at the most ideal location on the body based on the type of data to be monitored, which contributes to accuracy. For example, in cardiovascular monitoring, we will build devices ambulatory monitoring, enabling at-risk patients to avoid the risks associated with remaining as an inpatient, but providing a higher quality of data than can be achieved by other devices such as a smartwatch.

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

Expected Deliverables:

1. A home-made on-skin sensor system consisting of multiple home-made wearable sensors.
2. A home-made on-cloth sensor system consisting of multiple commercial miniature sensors.
3. APP for both on-skin and on-cloth systems.

Specialized Resources Provided by Client:

- nanomaterials printer, screen printer, 3D printer, elastomer manufacturing equipment.

Anticipated Cost: ___________________________ Financial Resources Provided by Client: 500

Preferred Students for the Project:

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

Anticipated Client Interaction (estimate):

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

### Meeting ABET Criteria

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

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

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

☑ Approved:  

☐ Project Assigned:  

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

Submitter Name: Henry Duwe, Nathan Neihart, Daji Qiao
Email: daji@iastate.edu

Project Contact: Daji Qiao
Email: daji@iastate.edu

Project Title: Battery-less IoT Devices

Project Abstract:
Self-sustainable IoT devices are required in many applications such as precision agriculture, infrastructure monitoring, and more. The goal of this project is to design and implement battery-less (thus more sustainable) IoT tags that are powered solely by energy harvested from wireless RF signal, and can perform basic operations such as sensing and computation. Each tag shall have the following components: (1) a circuit board (possibly with a micro-controller) designed and fabricated for basic processing, (2) an antenna for harvesting energy from wireless RF signal, and (3) an energy storage component (such as a super capacitor). Wireless signals emitted from a nearby signal generator (such as an RFID reader) will be used to power the tags.

Expected Deliverables:
The goal is to deliver a working prototype and a comprehensive final report by December 2019.

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: Prefer to have 3~4 E E students and 2~3 Cpr E students with the following skills: Circuit Design and Fabrication, Antenna Design, Embedded Systems and 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
   ☐ In person, ☐ Over the phone, ☐ Web / video conferencing
Meeting ABET Criteria

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

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

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

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

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

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

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

Project Approval – for use by ECpE Senior Design Committee

☑ Approved:  
sddec19-proj032

☐ Project Assigned:  

☐ Advisor(s) Assigned:  


Client/Company/Organization: Optical Operations

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

Project Contact: Daji Qiao  Email: daji@iastate.edu

Project Title: Vehicle-Operator Behavior Monitoring System

Project Abstract:
Public transportation or operating heavy-duty vehicles can be made much safer by gathering vehicle data (from its GPS location, as well as the CAN network of the vehicle) during operation and using them in an intelligent manner such as to report near-accidents. The goal of this project is to design and implement a web interface (both desktop and mobile versions) to (1) take the data reported by a data collection system as the input, (2) display the collected data in a professional, user-friendly and intuitive manner, and (3) display the output of a data analytics engine on the collected data. Throughout this project, team will work closely with graduate students, who will be responsible for the data collection system and the data analytics engine. The developed web interface will be tested and presented to DART (Des Moines Area Regional Transit Authority).

Expected Deliverables:
The goal is to deliver a working prototype and a comprehensive final report by December 2019.

Specialized Resources Provided by Client:
Tools such as Matlab Vehicle Network Toolbox are available for development and testing purposes.

Anticipated Cost: Financial Resources Provided by Client: Hardware and software needed in the project will be provided.

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

Other Special Skills: Prefer to have 4 Cpr E or S E students with the following skills: Web and App Development, Embedded Systems and Programming, Knowledge on Statistics and Machine Learning.

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:

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

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

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

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

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

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

Project Approval – for use by ECpE Senior Design Committee

☑ Approved:          sddec19-proj033
☐ Project Assigned:  
☐ Advisor(s) Assigned: 

__________________________________________
__________________________________________
__________________________________________
Senior Design Project Proposal Form

Client/Company/Organization: 

Submitter Name: Joseph Zambreno Email: zambreno@iastate.edu

Project Contact: Email: 

Project Title: Networked Arcade Platform

Project Abstract:

The goal of this project is to design a replacement for the existing arcade cabinets in the TLA with a more mobile, rugged, and reliable version. Hardware platforms, physical interfaces, screens, etc. are to be decided in collaboration with the client.

Expected Deliverables:

2 separate table-top cabinets made of either MDF or aluminum.

Specialized Resources Provided by Client:


Preferred Students for the Project:

☑ Electrical Engineering
☑ Computer Engineering
☑ Software Engineering
☐ Other: Other Special Skills: 1 team member should have machine shop experience or desire to learn.

Anticipated Client Interaction (estimate):

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

Meeting ABET Criteria

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

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

☐ 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:  sddec19-proj034

☐  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:  Data analytics for fleet management system

Project Abstract:
We have developed a system that collects data from vehicles and displays them to the fleet owners in a web interface. The object of this project is to extend the system with data analytics features that provide insights about the use of the vehicles.

Expected Deliverables:
Deliverable 1- A mobile application for tracing the use of the vehicles. (Semester 1).
Deliverable 2: A map that shows the driving patterns of each driver. (Semester 2)
Deliverable 3: A set of descriptive statistics and prediction models for the usage of the vehicles. (Semester 2)

Specialized Resources Provided by Client:
The students will have access to the hardware, source code, and servers needed to work on the project.

Anticipated Cost:  __________________________  Financial Resources Provided by Client:  None

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

Other Special Skills: (1) Development with Python for PI and JS for Node.js.

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

Meeting ABET Criteria

Please rate the following statements as they relate to your proposed project:
On this project, students will need to apply knowledge of mathematics, science, and engineering

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: sddec19-proj035
☐ 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 framework for IOT

Project Abstract:
We developed previously a framework for DevOps fo Node.JS. The developers can use the framework create Web applications and push them to GitHub. The framework automates the deployment process and collection of operation data. The goal of the project is to extend the framework to support IOT applications and also to provide basic services for micro-services such as fail detection.

Expected Deliverables:
Deliverable 1- Framework extension to deploy applications to raspberry pi, collect operation data and provide insight on the health of the application. (semester 1)
Deliverable 2- Framework extension to support micro-services development and deployment. (semester 2)

Specialized Resources Provided by Client:
Code of the current software.

Anticipated Cost: 
Financial Resources Provided by Client: None

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

Other Special Skills: Development with JS/Node.js and Python/Raspberry PI

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
Senior Design Project Proposal Form

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

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

Project Approval – for use by ECpE Senior Design Committee

☑ Approved: sddec19-proj036
☐ Project Assigned:
☐ Advisor(s) Assigned: