Senior Design Project Proposal - 1

Title	Use of Bluetooth® Smart to Locate Personnel, Equipment and Patients in a Hospital Environment
Sponsor	Extension Healthcare (Advisor : Dr. David Liu)
Type	☑ Application development ☐ Information systems ☑ Research-focused
Description	The Extension Engage Platform delivers critical alerts and alarms to clinicians. To deliver accurate messages to the clinician best able to respond correct location information for patients and equipment is necessary. Knowing the location of the clinician enhances the ability to notify the closest available clinician or suppress the notification if the clinician is already attending to the patient. The goal of this project is to create a proof of concept that demonstrates the use of Bluetooth Low Energy (BLE) and smartphones to locate personnel, equipment and patients. BLE devices are a low cost low energy and emit a Bluetooth signal that iPhones and Android devices can use to determine proximity. Extension expects the project to use BLE devices compatible with Apple's iBeacon specification. Assuming that each clinician is carrying a smartphone that has access to a central data collection server Extension seeks to answer: 1) When placing an iBeacon at a fixed location in a patient room, what is the proximity range that can be expected and how accurate is proximity? 2) How many and what is the best placement of iBeacons in a patient room to determine if a clinician is a) in the room, b) not in the adjacent room, c) entering the room and/or d) leaving the room? 3) Can the reliability of the iBeacon signal be characterized including items (lab equipment, people, etc) that might interfere with the iBeacon signal? 4) Can the location of a movable iBeacon (attached to a device or a patient) be determined passively? (Can a movable iBeacon location be determined by smartphones reporting the proximity of fixed iBeacons and movable iBeacons?) If so, to what level of accuracy? Location is not required or expected to be an absolute coordinate (GPS). Location may be relative to some point in the hospital or simply a named location, e.g. Room NICU 101, 1st Floor Hallway 6. Student's will be expected to 1) design and document a methodology for answering the questions, 2) create the software required to gather the necessary data, 3) plan the project, 4) review methodology with Extension staff and 5) provide status updates. The project should deliver 1) a report answering the questions with supporting data, methodology used and justification, 2) all supporting data and calculations and 3) software developed for Android or iOS and the central server used to gather location

	data. Optionally, students may which to develop a way to display the current location of their “clinicians”, “patients” and “equipment” on the server.
Team size	☐ 2 ☑ 3 ☐ 4 ☐ > 4
Required backgrounds	Mobile development, Java, quantitative data analysis, client server development
Required resources (HW/SW)	BLE devices compatible with iBeacon, Android or iOS devices, server. Extension prefers using Java for development. Use of Android devices will be more cost effective. If multiple types of devices and versions of Android are used reports should include variation in accuracy based on differences in the device.
Additional requirements	Weekly status report. Completion of 3 deliverables (see above). Review of methodology for answering questions.
Other notes	iBeacon is an Apple technology but is compatible with BLE.

Senior Design Project Proposal - 2

Title	Creating a Web application to map trail use and general bike and pedestrian activity in the Greater Fort Wayne area
Sponsor	City of Fort Wayne Greenways and Trails Department (Advisor : TBA)
Type	☑ Application development ☐ Information systems ☐ Research-focused
Description	The City of Fort Wayne Greenways and Trails Department is the city organization responsible for managing the City's trail system. CoFW Greenways and Trails Department desires a means of gathering information on the usage of its trails (e.g. most popular trails, frequency of use) and for enabling trail users to report problems with the trail system (e.g. weather damage). To that end, a group in the 2015-2016 senior capstone class created an iOS/Android app and server-side infrastructure to meet these requirements. The app allows trail users to record their activities on the trails and store them within a database. Users can view their past activities and achievements earned from those activities. This year's project group will expand on their applications and infrastructure to bring new features for the City of Fort Wayne. These include connectivity with the City's new 311 web service, expanded data visualization, a password recovery system, and a newsfeed system to allow users to receive updates from the City.
Team size	☐ 2 ☑ 3 ☑ 4 ☐ > 4
Requirement	**<u>Current Application Overview</u>** The current mobile applications have the following features: • basic account system (username/password) • basic achievement system • trail activity recording with GPS tracking and Google Map view with trail overlay • trail activity history viewing • static trail map **<u>Expected Features</u>** The additional features expected to be implemented for this project are as follows: • 311 API connectivity. Allow users to report trail problems via REST API to the 311 web service hosted by the city. Reports may include images, GPS coordinates, timestamps, issue category, and more.

	• Improved data visualization. The group completed a web application that consists of a simple heat map for visualizing trail user activity. Expand on this with more graphs to visualize the rest of user data. • Password recovery system. The apps should allow users to provide their email addresses, and the server should implement a password recovery service. News feed system. The City would like a means of connecting the apps to a news feed. This may mean connecting the app to a City Twitter account, to a newsfeed on the City's website, or creating a new news feed within the server infrastructure that city employees can post updates to.
Required backgrounds	Java, Swift, C#, SQL, REST, Mobile Application Development
Other notes	Other Possible Future Requirements • AWS back-end implementation • Templated app to allow other cities to plug-in their own information to make a version for their locality • Synchronization with music • Goal system: allow users to define their own goals, and have the app track progress towards those goals. • Account system and login for Web application so only authorized users can view the data visualization • On clicking a past activity, have the past activity that was clicked bring up a map view of the activity and the user can see where he or she was on the map. • UX: research, redesign, and refactor existing code-base with a focus on user experience. Considerations include look and feel, transitions, graphics. The current app has a very unsophisticated UX.

Senior Design Project Proposal - 3

Title	A Prototype System Exploiting Photogrammetry Technology for Wound Assessment
Sponsor	Parkview Research Center, IPFW Dept. of Nursing (Advisor : Dr. Beomjin Kim)
Type	☑ Application development ☐ Information systems ☑ Research-focused
Description	Best practice in wound care requires regular assessment of the wound to determine the progress of healing. The accuracy of this assessment is essential as clinicians determine treatment based on this information. Measurement of the wound's dimensions is one crucial aspect of assessment because a reduction in wound size is a good indication of healing. The current standard of care for wound measurement involves using a ruler or measuring tape to measure the wound's length, width, and depth at their greatest point (Fig.1). This manual method of measuring has limitations as it does not provide an accurate assessment of the surface area of the wound, and there is room for error between those performing the assessment. If an accurate assessment is not done, treatment of the wound can be impaired which can lead to delayed healing, infection, and more. The comparison of a wound from the last assessment would also be inaccurate if one or both of those assessments was inaccurate. A system for remote monitoring of wounds by healthcare professionals via internet-enabled mobile devices has potential uses in the home, home healthcare, remote locations, extended care facilities and more. The monitoring device consists of a viewer implemented through a web application to scan the wounds with accurate dimensions and upload the information to a remote server. The healthcare professional will be able to remotely access the scaled images for examination, annotation, and historical comparison. With this information they can advise the patient without repeated office visits. A more accurate assessment of the wound can guide treatment that could lead to better patient outcomes and satisfaction with their care. This project is an enhancement of a prototype system that was developed by a senior capstone project team in 2015-2016 academic year. The utilization of 3D vision technology can be a possible topic to evaluate the viability of incorporating stereoscopic devices to enhance wound assessment and subsequent treatment.
Team size	☐ 2 ☑ 3 ☑ 4 ☐ > 4

Current Version of System	The current WoundView app is able to: • Perform Creation, Read, Update, and Delete (CRUD) functions on various patient data. • Retrieve and present images with associated medical information from the database for wound assessment. • Capture images and/or videos via mobile devices. (However, only through the camera app on the device) • Transmittal of collected images to server(s) for storing and post-processing. • Data archiving, such as measurements. • Archiving images with associated medical information. • Secure login using username and password. • Implemented menu-driven interfaces for recording assessments, storing annotation, and documenting the wound healing progress. • Created a digitized measuring system. First you calibrate the distance using a calibration card and then the user can click on two points.
Possible Future work	• Calculate depth from image(s) • Integration of 3D image capturing devices • Add more graphs and analytical tool to the web app • 3D Model Creation & Mapping • Viewing and image analysis tools for tunneling under the skin • Mobile App development, true portability • Create a slideshow of re-centered images for comparison • Image analysis for patterns, such as rashes, skin legions • Push evaluation results to the electronic medical record. • Add strong password encryption
Required backgrounds	Web App Development, Data Communication, Database Administration, Image Processing, Optional: Mobile App Development
Required resources	Mobile devices, server(s), Optional: Camera/Scanner
Additional requirements	• The project sponsor or the IAV Center will provide required devices implementing the system.

Figure 1. Measurement of wound length, width, and depth using a ruler (current standard of care)

Senior Design Project Proposal - 4

Title	Real Autobots and Decepticons: Programming a Self-Reconfiguring Robot
Sponsor	IPFW College of ETCS (Advisor : Dr. John Licato)
Type	☐ Application development ☐ Information systems ☑ Research-focused
Description	A senior project group in ECE has been creating a robot array consisting of several modular units that can reconfigure themselves into a wide variety of possible arrangements. Ideally, the robots would be able to form (for example): a bridge, stairs, a wall, etc. These robots will communicate with each other using a well-known protocol such as wifi or Bluetooth. However, their artificial intelligence still needs to be programmed. Coming up with a possible shape to transform into is relatively easy, but actually coming up with a step-by-step plan so that the robot modules can move into place without any human assistance, is a more difficult AI problem. The CS senior design team will create such algorithms, by first developing a simulation platform for transformations, then implementing them on actual modular bots. In addition to working with Dr. Licato, the CS senior design team will work with the ECE senior design groups in a first-ever collaboration between departments of its type here at IPFW.
Team size	☑ 2 ☑ 3 ☑ 4 ☐ > 4
Required backgrounds	Preferred languages: Python (or willingness to learn) Preferred coursework: Artificial Intelligence, Algorithms, and/or any coursework involving design and implementation of planning algorithms
Required resources (HW/SW)	Robotics hardware will be provided to the students. CS students are expected to have laptops to work with.
Additional requirements	None.
Other notes	Progress made in this project will be used as a launching point for at least one external funding proposal to be written by Dr. Licato, in collaboration with other ETCS Faculty (Drs. PomalzaARaez (ECE), Liu (ECE), and Bi (ME)). The robotics projects and code completed by the CS and ECE senior project teams will be used in future robotics courses here at IPFW.

Senior Design Project Proposal - 5

Title	Indiana Vertebrate Atlas
Sponsor	IPFW Environmental Resources Center (Advisor : TBA)
Type	☑ Application development ☐ Information systems ☐ Research-focused
Description	The Indiana Vertebrate Atlas is a multi-platform application for managing observations of vertebrate species found in Indiana. Features include: • Real-time submission of an observation of any vertebrate. Submissions made by citizen scientists or wildlife enthusiasts is verified by one or more designated experts. Data recorded includes location, vertebrate name, date and time, name of observer, and photo. • Listing of vertebrates likely to be found in a particular habitat, e.g., state park, nature preserve, county or other geographic boundary. • Listing of vertebrates recently seen in a particular habitat. Vertebrate sittings might also be displayed on a map of the habitat. • Lookup of information about a particular vertebrate, including photo, scientific and informal name, description of habitat and other useful information. • Capability to ask an expert asking to identify a vertebrate captured in a photo. • Statistical reporting of vertebrate observations filtered by location, date range, observer, or vertebrate name. • User registration and management. At least two levels of users would be identified, those who are vertebrate experts and those who are not. • Import and export of historical observation data.
Team size	☐ 2 ☐ 3 ☑ 4 ☐ > 4
Required backgrounds	Web development (HTML, JS, CSS, PHP, JSON, possibly Bootstrap or other front-end frameworks), mobile development (IOS, Android), Database, possibly CMS frameworks such as Wordpress.
Required resources	None specifically
Additional requirements	(1) Review previous work done at IPFW deployed on IPFW Topaz server. (2) Integrate with HerpMapper database (https://www.herpmapper.org/) maintained by outside collaborators

Senior Design Project Proposal - 6

Title	Find Foods that Fit - Development of a web application for customizing nutrition plans/ physician prescribed diets through compiling information from web resources
Sponsor	RINEHOLD Nutrition Services, LLC (Advisor : TBA)
Type	☑ Application development ☐ Information systems ☐ Research-focused
Description	Health conditions may be controlled or avoided by adding or eliminating certain food items and nutrients from the diet. Searching for specific nutrition info and creating meal plans by hand can be time consuming for the practitioner. During Senior Capstone 2015-2016, Team#3 developed a web application that provides a highly personalized, yet simple way to find recipes for diet assistance in order to reduce time creating meal plans. The application allows the health practitioner to find recipes based on selected food items which the practitioner's patient can have or should avoid. These recipes, along with the food item list, are used to generate personalized meal plans for the patients. This year's group will develop a web application which will allow the patient to view his/her meal plans and generate a grocery shopping list based on the recipes present in the meal plan. The team and sponsor can work with a store in order to retrieve data (web crawling/scraping) about products which can be used for the grocery shopping list generation. To achieve this, the new team will also expand the current web application by integrating patient data as well as meal plan data. The new team will also be able to utilize web crawling/scraping for recipe retrieval using one or multiple commercial websites.
Team size	☐ 2 ☑ 3 ☑ 4 ☐ > 4

Requirements	**Current Application Overview**
	The current web application has the following features:
	• Recipe retrieval through web crawling/scraping from blog/commercial website
	• Generate meal plans using retrieved data
	• Locally save as .pdf file and/or print meal plans
	• CRUD operations for recipes and categorized food items
	
	Expected Features
	The features expected to be implemented for this project are as follows:
	• Develop a patient side web application with the following features:
	  • Implement login/logout for users/admin.
	  • Allow the patient to view his/her meal plans.

	• Generate a grocery shopping list based on the meal plans.
	• Automatically populate online shopping cart with shopping list.
	• Expand the current application as follows:
	  • Store patient and meal plan data.
	  • Utilize one or multiple commercial websites for web crawling/scraping to retrieve recipe data.

Optional Features	**Mobile:** • Add styling for application to be used in mobile browser. **Pictures:** • Scrape recipe data with crawler. • Allow user to upload pictures. **Serving Sizes:** • Allow dynamic changes to serving size for each recipe.
Recommended backgrounds	• Web application technologies: Ruby on Rails, PostgreSQL, HTML5, CSS3/SASS, Bootstrap/jQuery, etc. • Web crawling/scraping

Senior Design Project Proposal - 7

Title	Establish trustworthy and accountable streaming forensics data transmission for chain-of-custody in the Cloud
Sponsor	Department of Computer Science (Advisor: Dr. Anyi Liu)
Type	☐ Application development ☐ Information systems ☑ Research-focused
Description	This research project is designed to develop a secure methodology of seizing and transmitting forensic data in a Cloud Computing environment, with the emphasis on the establishment of trustworthy and accountable data collection, transmission, analysis, and presentation process. Based on my prior research, this project will focus on establishing trusted relationship between Cloud nodes and transmitting forensic streaming data with the capability to check malicious tampering, such as insertion, deletion, and modification, the goals of this CS460/465 project will focus on 1) ensuring confidentiality, integrity, and non-repudiation of forensic data during data collection and transmission process; 2) restricting the capabilities of custodies during data possession phase; and 3) maintaining a list of non-fungible logs for data access activities for all the custodies in the chain of forensic data possession. The proposed research activities of the student team will include, but not limit to: 1) researching the literature of information security and digital forensics; 2) constructing experimental environment; 3) maintaining regular contact and discussion with the faculty advisor; 4) developing the prototype based on the discussion; 5) conducting meaningful evaluation; and 6) preparing partial content for the peer-review publication. By the end of CS460/465, a functional prototype is required, on which the evaluation will be conducted by a set of experiments. A formal technical report is required to demonstrate the achievement of this project.
Team size	☑ 2 ☐ 3 ☐ 4 ☐ > 4
Required backgrounds	Information security, networking, cryptography, security protocols, etc. Preferably, Strong self-motivation. Strong C & Linux hands-on experience. Some background knowledge of digital forensics.
Required resources	HW: Laptop and Mobile device SW: Open Source and Freeware
Additional requirements	• Literature survey • Weekly or Bi-weekly, Midterm Report, and Final Report • Experimental evaluation • Optional: Peer-review conference and/or journal paper(s)

Other notes	Students can use the server(s) in my office for the prototype construction and evaluation.

Senior Design Project Proposal - 8

Title	NeoSBC
Sponsor	INdigital telecom (Advisor: Dr. Zesheng Chen)
Type	☐ Application development ☐ Information systems ☑ Research-focused
Description	The NeoSBC stands for New Session Border Controller. The Session Border Controller is used in 911 telecommunications to connect the Emergency Service IP Network with the outside world. The session border controller will control protocol negation between two entities, provide security against DOS Attacks, and be topology hiding. The neoSBC is a project provided by a local 911 company called INdigital Telecom, who recognizes a need for an open source SBC. INdigital currently has a closed source SBC made by their employees but is looking to replace the product with the neoSBC's open source solution.
Team size	☐ 2 ☑ 3 ☐ 4 ☐ > 4
Requirements	1. Python based, supporting Cython compilation. a. Use Python b. Python Supports compiling into binary with Cython. 2. SIP Stack supporting B2BUA with forwarding of calls a. Finish SIP Stack b. Finish B2BUA c. Finish/Fix State Machine for forwarding calls 3. Session and Application State synchronized a. Finish SIP Session Distributed Dictionary b. Move PDU encoding to "NetString" c. Finish State Machine for distribution of next state. 4. Syntax based Security a. Finish Security Syntax b. Optimize, aka fix, lexical parser. 5. NFV/SDN concept of Control/Data Plane a. Finish NFV 'lite' model b. Control Plane and Data Plane synchronization over IP
Optional features	1. Black Listing offending IPs using PF. 2. Replace OpenBSD's CARP with Raw Sockets user-land IP stack model. 3. High Availability peering with stateless proxy.
Required backgrounds	1. Ability to Program in Python or experience with similar language. 2. Familiarity with Linux or Unix OS CLI usage. 3. Familiarity with VM and related Network Configurations. 4. Network Programming experience, TCP/UDP Client/Server using sockets and/or twisted a plus.

	5. VoIP, specifically SIP experience a major plus.
Other notes	The partially completed source code for this project is Open Source. It was started as an internal INdigital telecom project and was recently released to the public. INdigital will sponsor the development within our Github page. INdigital will also provide required documentation and the needed mentoring to complete the project.

Senior Design Project Proposal - 9

Title	User Interfaces: Collecting and Visualizing Design Data for a Fortune® 500 company
Sponsor	Lincoln Financial Group (Advisor : TBA)
Type	☑ Application development ☑ Information systems ☑ Research-focused

Description	• Lincoln Financial Group℠ (Lincoln) is a Fortune® 500 company with a national customer base. Lincoln offers a variety of retirement solutions and financial services to our trading partners.
	  ○ We want this to useful to the students in a broader way as well – we would like them to see the "inner workings" of a publicly-traded company, and one that integrates the business and IT sides every day in order to be successful.
	  ○ We will take that on as our responsibility – our part in this mutual collaboration with you.
	• The goal of this project is to work with our Business Development team, which has oversight of the tools that bring in over $11B in annual premiums, and service approximately 1M customers.
	  ○ Specifically, the goal is to help us understand our users in more deep and meaningful ways.
	  ○ Lincoln will provide details of several tools that we use today, as well as an overview of the business side. We can help students understand more about the business side, and where various departments add value in the context of an organization.
	  ○ The end result will show Lincoln how our consumers use a variety of our software tools – essentially how they interact with us. This will help Lincoln design them better, and remember to keep customer usage engaged. Ultimately, this will help reduce our need to take "educated guesses" of what works vs. what does not.
	  ○ We will of course explain each of these, how they work today, how they should work after the Senior Capstone effort, and how this will add value. We will describe the Lincoln business and IT impacts for each, in order to be educational for you.
	• We will help make sure that your progress is tracking along. We view this as a partnership, not us off-loading work to you.

Team size	☑ 2 ☑ 3 ☑ 4 ☐ > 4
Required backgrounds	We are open to various backgrounds, but particularly those students who have an interest in user interface, data analytics, visualization, etc. Students will learn about how Lincoln's consumers interact with us through third-party tools, or native websites, fillable forms, etc.

Required resources (HW/SW)	It is assumed that students will use IPFW's hardware and the related software associated with so-called "eye tracker/mouse tracker" tools. Once the data is collected, it can then be interpreted and represented in a way that is visual and useful. Data presentation will show quantitative measures. This hardware was discussed through the IPFW Professional Advisory Board as a community partnership, and Lincoln is interested in furthering this partnership.
Additional requirements	**UTILIZE SCREEN-TRACKING TOOLS** **Description:** We would like to partner with IPFW to leverage their "eye tracker/mouse tracker" and other tools/technologies to learn how our consumers experience Lincoln's online offerings. We would like to partner with the students to learn how our customers interact with our websites and other tools. This will help us understand snags, pauses, time bottlenecks, points of confusion, potential Not In Good Order errors, etc. This may turn into (we hope) a long-term relationship for this type of partnership. We can help IPFW learn more about our design constraints and typical customer base. **Requirements:** 1. Collaboration with IPFW students and the administrators of these tools. 2. We will give students test IDs and passwords, and request their feedback on how to improve our services.

Senior Design Project Proposal - 10

Title	ACPL equipment reservation system
Sponsor	Allen County Public Library (Advisor : TBA)
Type	☑ Application development ☑ Information systems ☐ Research-focused
Description	The Library is in need of an online system where in house equipment can be loaned out for a partial day, several days, or weeks at a time. Staff would be able to access this system from a web browser and choose the item or items they would like to reserve and the reservation time period. Some of the requirements include: • Select an item or items for loan from an item pull down • Ability to see in a calendar view the dates and times that items selected are available and reserved • A staff member will be able to reserve items for a specified time; they will receive a confirmation via email • Generate reports for the person responsible for shipping the materials; pickup and delivery needs • Checklist of number of pieces shipped and received • Integration with active directory • Ability to track who has equipment at any given time • Generate usage reports
Team size	☐ 2 ☐ 3 ☑ 4 ☐ > 4
Required backgrounds	Web app development, database, UI design
Required resources (HW/SW)	Web server, database
Additional requirements	
Other notes	

Senior Design Project Proposal - 11

Title	App to run as a Self-Service Kiosk at National Shows
Sponsor	Our Sunday Visitor, Huntington, IN (Advisor : TBA)
Type	☑ Application development ☐ Information systems ☐ Research-focused
Description	Our Sunday Visitor would like to have a touch enabled, "kiosk" product sales application developed for use by our sales team at National Shows. Typically, during shows, our sales team must balance selling products against establishing relationships with current and prospective customers. This app would assist our sales team by allowing customers to purchase products directly, while allowing the sales team to focus on building relationships. For National Show attendees who would like to purchase a featured product online, the Self-Service Kiosk Application is a secure, touch interface, Windows Application that will allow users to select featured product(s), enter quantities, and purchase via their Credit Card. During a National Show, attendees attend various workshops and presentations where speakers often have books, subscriptions (print or digital), or other products to sell via Our Sunday Visitor. In addition, Our Sunday Visitor may identify additional products to feature and sell at National Shows. All of the products will exist in Our Sunday Visitor's Enterprise Resource Planning (ERP) system and the Windows Application will interface with the ERP system for product information and order placement. (Bonus Feature: Support in-hand product purchasing by scanning the product's ISBN to select the featured product and determine the quantity)
Team size	☐ 2 ☑ 3 ☑ 4 ☐ > 4
Required backgrounds	Web & Windows Desktop Programming (.NET, C#), Mobile Application Development, MSSQL
Required resources (HW/SW)	SW: Visual Studio, SQL Management Studio, Windows 10 HW: Windows 10 Development PCs and any Windows 10 touch screen device with a minimum 12" screen size for kiosk testing
Additional requirements	Our Sunday Visitor will need to maintain the source code for this application, so it must have unit tests, and be well documented.
Other notes	We feel this application is ideal for a senior project. It can easily be broken down into features: • Attract/Splash Screen • Product Selection Screen

	• Credit Card Payment Screen • Purchase confirmation email • Interface with backend ERP • Product Scanning Screen (if time permits)