ECE 442/510
Internet of Things and Cyber Physical Systems

Syllabus
Summer 2022

Jafar Saniie & Won-Jae Yi

Syllabus

Instructors	Dr. Jafar Saniie (saniie@iit.edu) Dr. Won-Jae Yi (wyi3@iit.edu) Office Hours: by appointment in advance Office Location: Meet online (Zoom)
Teaching Assistant	Mr. Mikhail Gromov (mgromov@hawk.iit.edu) Office Hours: by appointment in advance Office Location: Meet online (Zoom)
Class Time	Wednesdays and Thursdays, 9:00 AM to 12:00 PM Class runs until June 23rd
Class Location	Zoom (link available under "Zoom Class Meeting" on Blackboard)
Prerequisites	ECE 242 or Consent of Instructor or Graduate Standing General understanding of writing computer programs and embedded computing Basic knowledge of computer architecture and network communication system

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Class Website	Illinois Tech Blackboard	
Textbook	There's no required textbook for this course. Lecture slides will be uploaded to the Blackboard. (password protected)	
Reference Books	"Internet of Things and Data Analytics Handbook" By H. Geng John Wiley & Sons, Inc., 2016 ISBN: 978-1119173649	"Cyber-physical Systems" By R. Rajkumar, D. de Niz and M. Klein Addison-Wesley, 2016 ISBN: 978-0321926968
	"Internet of Things: Principles and Paradigms" By R. Buyya and A.V. Dastjerdi Morgan Kaufmann, 2016 ISBN: 978-0128053959	"Internet of Things: A Hands-On Approach" A. Bahga, V. Madisetti, VPT, 2014 ISBN: 978-0996025515
	"Making Things Talk", 3rd Edition By Tom Igoe Maker Media, 2017 ISBN: 978-1680452150	"Raspberry Pi Sensors" By Rushi Gajjar Packt Publishing, 2015 ISBN: 978-1784393618

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Course Objective	• To introduce students to the fundamentals of Internet of Things (IoT) and embedded computing • To provide understanding of utilizing IoT to build cyber physical systems • To understand various data communication methods enabling data mobility in real-time • To understand how to analyze and visualize user data • To provide comprehensive understanding of IoT by exploring real-world IoT application scenarios • To gain a better understanding of various technologies that can be utilized for IoT implementations
Topics Covered	• Introduction to Internet of Things and Cyber Physical Systems • Domain Specific IoTs and IoT Design Case Studies • Introduction to Embedded Systems • Design with Arduino and Raspberry Pi • IoT Sensors and Actuators • IoT Networking Technology (Wi-Fi, Cell, Bluetooth, ZigBee, NFC, RFID) • DBMS and IoT Cloud Platform Design • IoT M2M and Middleware Architecture • Security and Privacy • Cybersecurity Law

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Grading	• Attendance: 5% • Reading Assignments: 20% • Design Laboratory Experiments: 30% • Design Project and Presentation: 45%
Homework Policy	• All homework assignments and presentation need to be submitted to the Blackboard. • Late submission will not be accepted nor graded. • Working together on all assignments are encouraged but **copying assignments will call for disciplinary action.**
Assignment Policy	• Design Project: **In groups of two** • Design Laboratory Assignments: **work in group but individual reports** • Reading Assignments: **individual reports** • **You are responsible for the parts required in your Design Project and Design Laboratory Experiments**

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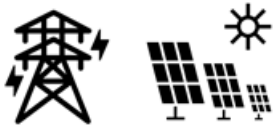
Academic Honesty	It is your responsibility to be familiar with Illinois Tech Code of Academic Honesty: https://web.iit.edu/student-affairs/handbook/fine-print/code-academic-honesty Working together on the assignments are encouraged **but copying assignments will call for disciplinary action. All submissions including exercises, programming assignments and exam papers must be your own.** If the above policy and/or any part of the Illinois Tech Code of Academic Honesty is violated in any similarity within the Reading Assignments, Research Projects, Design Laboratory Experiments, programming assignment codes, comments, customized program behavior, any writings and/or figures are found, both the helper (original source of work submission) and the requestor (duplicated/modified work submission) will be called for academic disciplinary action including zero score of the submission/exam **AND** degrading course letter grade by one. If the above policy and/or any part of the Illinois Tech Code of Academic Honesty is violated in any similarity within Design Project and Presentation, both the helper (original source of work submission) and the requestor (duplicated/modified work submission) will receive a failing grade E for this course, and will be notified to the student's advisor, department and the university.

IoT Application Domains

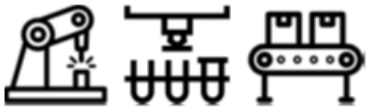
APPLICATION DOMAINS

Vehicle, Asset, Person & Pet Monitoring and Controlling

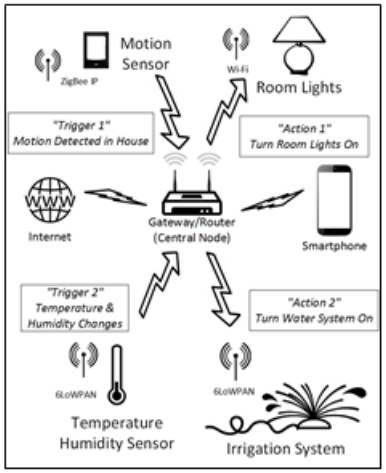
Agriculture Automation



Energy Management



Factory Automation



Home Automation

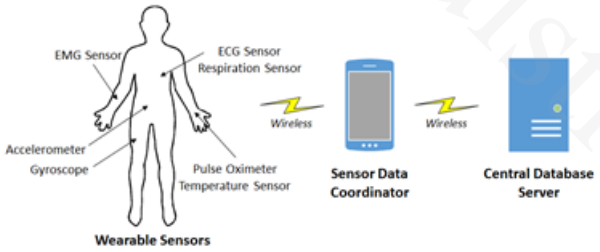
Smart and Connected Systems

Building Management

Smart Transportation

Daily Activity Things

Smart Security

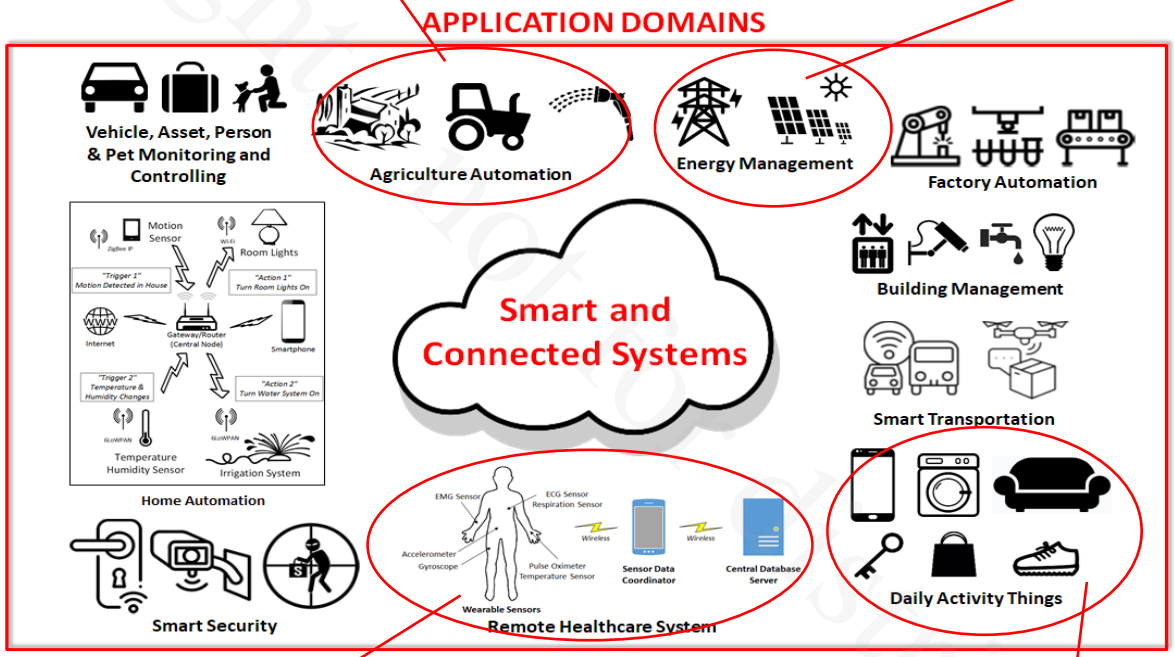


Remote Healthcare System

IoT Application Domains

Smart Irrigation System by
Salih Usta
Link to Published Paper

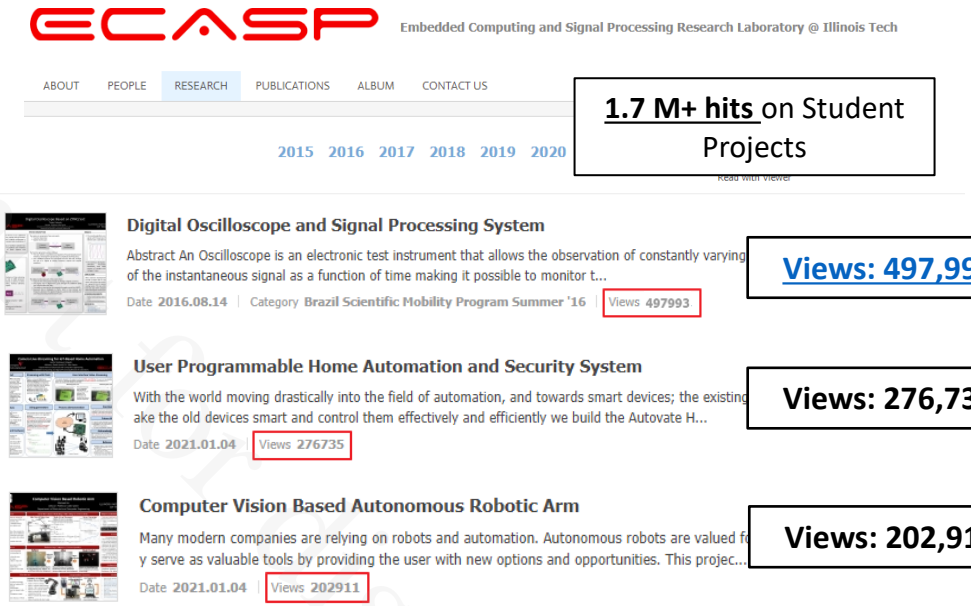
IoT Smart Power Socket by
Fernando Almagro and Carlos Mateo
Link to Published Paper



IoT Health Monitoring System by
David Arnold and Andrew Mustea
Link to Published Paper

IoT Smart Workout System by
Jose Toledo
Link to Published Paper

Focus on Student Success – ECASP Website Facts (2015-2022)

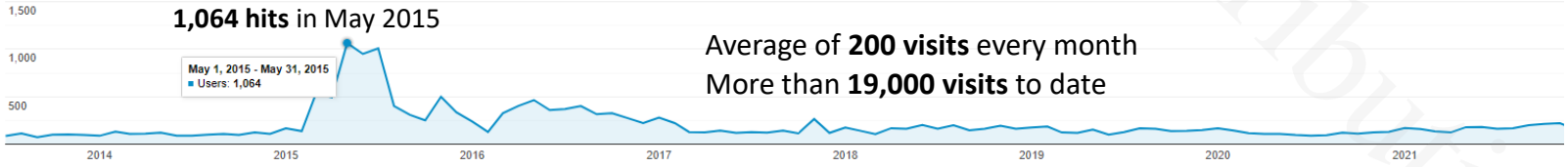


1.7 M+ hits on Student Projects

Views: 497,993

Views: 276,735

Views: 202,911



1,064 hits in May 2015

Average of **200 visits** every month
More than **19,000 visits** to date

Team Arrangements – Summer 2022

ECE 442 Group

- Samuel Kalenowski and Alan Palayil
- Hamad Abdelrahim and Nikhil Aditya Chaganti
- Wen Hao Yu and Phu Trinh

ECE 510 Group

- Lisa Duperray and Sarah Hugue
- Rajesh Kumar Krishnan and Simrat Kaur
- Jahangir Ali and Chenglong You
- Maureen Rakotondraibe and Jacob Solus
- Patrick Burgess and Satvik Reddy Kamidi (change to ECE 510)
- Ravishankar Natarajan

Parts for Design Laboratory Experiments

Name	Manufacturer	Part Number	Links
Arduino UNO board KIT	ELEGOO UNO Project Super Starter Kit	EL-KIT-003	https://tinyurl.com/ycn9pl42
Arduino UNO board KIT includes all necessary parts for Lab 1, jumper wires for Lab 2, jumper wires and Temperature/Humidity Sensor for Lab 3			
Raspberry Pi KIT ***International shortage*** 😖	At least one Raspberry Pi 3B+ or better with at least **8GB microSD card, USB reader for microSD card, 2.5A power adapter, clear casing, heat sink** for RPi (touchscreen, HDMI cable are optional, not necessary)		https://www.amazon.com/s?k=rasbperry+pi+4&crid=19N1B70EXFGB1&sprefix=rasberry+pi+4%2Caps%2C116&ref=nb_sb_noss_2 https://tinyurl.com/t44ypwf (uSD Card) https://tinyurl.com/yck3tch3 (uSD Card USB Reader)
Accelerometer	HiLetgo[1] or Adafruit[2]	GY-291[1] or ADXL345[2] (requires soldering)	https://tinyurl.com/y4y58paf (GY-291) https://tinyurl.com/ydzdzmpj (ADXL345) https://www.adafruit.com/product/1231
Soldering Iron Kit			https://tinyurl.com/yanupbfe
Bluetooth	DSD Tech	HC-06 Bluetooth 2.0	https://tinyurl.com/y44p8vtv