CS3907: IoT and Edge Computing Applications
From introduction to interface with the physical world
Spring 2023
3 credit course for undergraduate students
Department of Computer Science
Instructor: Kartik Bulusu

Short description:

The Internet of Things (IoT) is perceived as a technology involving a collection of smart, connected devices with the ability to send and receive data; "internet" encapsulates connectivity and "things" are physical devices (electronic or mechanical) that can be adapted toward connectivity. There is an alternative perception of IoT, as a design methodology that facilitates interoperability and connectivity of physical systems. Edge computing is a strategy for localized analysis of data, before it is moved into the pipeline of powerful data center- or cloud-based post-processing.

This course explores the above-mentioned aspects of the IoT framework and expands it with edge computing ideology via practical and hands-on exposure. Students will be exposed to the IoT framework using a variety of sensors, IoT automation and connectivity in "microLabs" that incorporate the Raspberry Pi (single-board computer) and Python programming language. The goal of the course is to introduce the students to the building blocks of the IoT ecosystem with emphasis on Edge Computing. The students will learn about how IoT with edge computing capability is going to be the backbone of the Industry 4.0 by projects, case studies and a discussions with industry and academic experts.

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Goal:

The goal of the course is to introduce the students to the building blocks of the IoT ecosystem with emphasis on Edge Computing.

Learning objectives:

1. Hands-on knowledge of Raspberry Pi hardware with Python programming language
2. Exposure to various sensors and actuators with hands-on exercises and in-class IoT projects
3. Exposure to IoT automation platforms such as ThingSpeak, Cayenne and IFTTT
4. Implement Raspberry Pi-based IoT projects
5. Implement edge computing strategies with the Raspberry Pi
6. Gain industry 4.0 exposure via invited speakers and case studies

Learning Outcomes:

As a result of completing this course, students will be able to:

1. Understand the IoT framework and implementation using the Raspberry Pi   .
2. Perform experiments aimed at collecting and analyzing data.
3. Design and write Python programs and work with IoT automation platforms.
4. Work on engineering-innovation group projects.

Additional Learning Outcomes:

- Ability to apply knowledge of programming and mathematics in the IoT framework
- Ability to design and conduct experiments, as well as to analyze and interpret IoT data
- Ability to identify, formulate, and solve physical problems using the IoT framework
- Ability to use the techniques, skills, and modern computing tools necessary for practical implementation of IoT technologies

Course format:

- Lectures on the fundamentals of Raspberry Pi programming using Python programming language.
- Lectures on sensing, actuation and automation and IoT connectivity methods.
- Case studies on IoT with Edge computing from a variety of sectors such as Agriculture, Home Automation, Healthcare etc.
- Guest lectures from Industry 4.0 and academic experts
- Hands-on in-class work and Project-based deliverables
- Interactive quizzes and instant concept checks
- Individual and group assignments
- Midterm and Final projects

Audience and credit-level:

The course is designed for junior-level undergraduate students as a 3-credit course.

Prerequisites: CSCI 2113

Workload:

This course will have 150 minutes of lecture time per week, that includes approximately 60-75 minutes of hands-on, microlab work. The course requires between 2-4 hours per week on average for homework assignments or project-based deliverables.