

Lecture Contact Hours: 32-36; Outside-of-Class Hours: 64-72;
Laboratory Contact Hours: 48-54; Outside-of-Class Hours: 0;
Total Student Learning Hours: 144-162

CUYAMACA COLLEGE
COURSE OUTLINE OF RECORD

Computer and Information Science 170 – Internet of Things (IoT) – Connecting Things

2 hours lecture, 2 units
3 hours laboratory, 1 unit
Total units: 3

Catalog Description

From washing machines to sophisticated components of an airplane's jet engine, even organic items like crops and cows, nearly every object can now be connected to the Internet. The ability to connect things and capture useful data from these connections is transforming organizations in every industry and opening doors for new career specializations. This course is for people who love creating devices. From designing electronic circuits to writing code, the IoT (Internet of Things) provides the platform for various types of professionals. The goal of this course is to explore things and their connection to the IoT by conducting hands-on labs both individually and as a member of a team. Discover the basis of this exciting and emerging field using fun, hands-on activities to model securely connecting sensors to cloud services over IP networks and collecting data in an end-to-end IoT system. While an understanding of basic programming (such as PCAP: Programming Essentials in Python), networking and electronics knowledge is useful, it is not required.

Prerequisite

None

Entrance Skills

Without the following skills, competencies and/or knowledge, students entering this course will be highly unlikely to succeed:

- 1) The ability to read and follow instructions, basic Math skills, and basic computer use skills.

Course Content

This course introduces students to the "Internet of Things" (IoT) and how physical or real-world devices, "things," are increasingly being connected to, visible through, and controllable via the Internet and web technologies. This course is project based where students will work individually and in teams to explore and build IoT devices/solutions using System on a Chip (SoC) technologies like the Raspberry Pi and microcontrollers like the Arduino using basic Python and C programming languages.

- 1) Things and Connections
 - a. Defining devices
 - b. Connections
 - c. Network basics
- 2) Sensors, Actuators, and Microcontrollers
 - a. Types of Sensors
 - b. Utilizing Actuators
 - c. Using Microcontrollers to activate Actuators and collect data from Sensors
- 3) Software is Everywhere
 - a. Basic programming fundamentals in Python
 - b. Physical programming using Raspberry Pi and Arduino

- c. Using programming to control Actuators and gather data from Sensors
- 4) Networks, Fog, and Cloud Computing
 - a. Designing data collection networks
 - b. Creating Fog controller devices and data transmission device
 - c. Collecting data from Fog devices and using Cloud computing to analyze IoT data and act on the results of analysis
- 5) Digitization of the Business: IoT applications in Business
 - a. Define IoT solutions used in business: Manufacturing, Safety, and compliance
- 6) Create an IoT Solution
 - a. Define a problem that requires an IoT solution
 - b. Determine solution requirements (devices, network, programming)
 - c. Implement the solution

Course Objectives

Students will be able to:

- 1) Interdisciplinary IoT systems (electronics, networking, programming)
- 2) Design thinking, prototyping and troubleshooting.
- 3) Develop critical thinking and problem-solving skills using physical equipment and computer emulation.
- 4) Soft skills: teamwork, articulate problems and solutions in a business context.

Method of Evaluation

A grading system will be established by the instructor and implemented uniformly. Grades will be based on demonstrated proficiency in the subject matter determined by multiple measurements for evaluation, one of which must be essay exams, skills demonstration or, where appropriate, the symbol system.

- 1) Assignments
- 2) Quizzes
- 3) Final Project (Design, build and implement an IoT solution)
- 4) Exams.

Special Materials Required of Student

None

Minimum Instructional Facilities

Lab equipped with a computer and internet access

Method of Instruction

Lecture, Labs, and Out-of-Class Assignments

Out-of-Class Assignments

- 1) **Reading:** Assigned textbook readings on the Introduction to the “Internet of Things” and “Practical Internet of Things Security” and journal articles and whitepapers that focus on Internet of Things implementation, operation and security.
- 2) **Writing:** Generate content for a Home Assistant (an Internet of Things integration platform) dashboard using telemetry data, images, graphs and videos and write a “User Guide” for the Home Assistant environment.
- 3) **Other:** Use online circuit design tools, such as TinkerCAD, design, build and program simulations of different Internet of Things circuits. Use online virtualized environments, such as NETLAB+ to complete lab assignments in Internet of Things topics, for example, Security, Critical Infrastructure, Storage Technologies and Media Distribution.

Texts and References

- 1) Required (representative examples): Introduction to the Internet of Things, Ahmed Banafa, ISBN: 978-84-7022-445-1. Practical Internet of Things Security, Brian Russell and Drew Van Duren, ISBN: 978-1-78862-582-1
- 2) Supplemental: YouTube videos such as “The Anatomy of an Attack” and “How a Gamer Crashed the Internet | The 2016 Mirai Attack”. Internet tutorials such as, “Ultimate Home Assistant Beginner’s Guide!”. Online virtual labs using NETLAB+.

Exit Skills

Students having successfully completed this course exit with the following skills, competencies and/or knowledge:

- 1) Describe the use of Sensors, Actuators and Microcontrollers
- 2) Assemble appropriate Sensors, Actuators and Microcontrollers to apply to a specific project in IoT
- 3) Program microcontrollers
- 4) Define and analyze an IoT problem
- 5) Design and implement a solution for an IoT problem

Student Learning Outcomes

Upon successful completion of this course, students will be able to:

- 1) Analyze the things and connections that make up the IoT.
- 2) Build sensor/actuator systems using the Arduino microcontroller.
- 3) Create programs in Python that provide IoT functionality to the Raspberry Pi single-board computer.
- 4) Design and create an end-to-end IoT system that can solve a problem of interest to the student.