Miami Dade College

Course Description

CET2186C | Design and Prototyping of Connected Devices |4.00 credits

This course provides the student with the foundational concepts to integrate hardware and software to produce prototypes of connected devices. As part of the course, the student will develop creative thinking and problem-solving skills to design Internet of Things solutions by combining existing hardware and software tools. Prerequisite: COP1334.

Course Competencies:

Competency 1: The student will demonstrate an understanding of Design Thinking for IoT by:

1. Defining Design Thinking and each of its stages
2. Explaining how to discover the user's needs and how to estimate the feasibility of a solution
3. Defining Minimum Viable Product
4. Solving challenges in teams, proposed by the instructor, developing duct tape prototypes
5. Summarizing the challenges and opportunities that IoT brings to solve everyday issues

Competency 2: The student will demonstrate an understanding of fundamental electronic concepts by:

1. Defining current, voltage, ground, resistance, and power
2. Describing the functions of resistors, transistors, diodes, LEDs, capacitors, and integrated circuits
3. Comparing the ins and outs of connections (digital outputs, digital inputs, analog inputs, analog outputs and serial communications)
4. Comparing Direct Current (DC) with Alternating Current (AC)
5. Researching about physical and digital interfaces between the user and the product

Competency 3: The student will demonstrate an understanding of soldering and assembling electronic prototypes by:

1. Setting up the workspace and identifying all the components involved in the process (Such as wires, breadboards, multimeter, wire cutters, heat gun, soldering iron kit, disordering braid, helping hands, etc.)
2. Explaining the safety concerns when soldering
3. Performing the soldering of wires and through-hole soldering of components
4. Showing how to use the multimeter to read the electrical values of a circuit
5. Assembling circuits with the same components in parallel and series and comparing voltages and currents

Competency 4: The student will demonstrate an understanding of programming development boards by:

1. Defining the concepts of gateways, backend, firmware
2. Defining different development boards and listing its compatible operating systems
3. Understanding the components of a program for a development board (Such as Variables, Functions, pinMode(), digital Write(), and delay(), setup() and loop())
4. Uploading and running sample programs to development boards that include digital outputs, digital inputs, analog inputs, analog outputs, if/else statements, loops, and functions
5. Modifying sample programs to adjust their parameters

Competency 5: The student will demonstrate an understanding of working with displays, speakers and sensors for development boards by:

1. Defining LED displays, speakers, cameras, accelerometer, gyroscope, magnetometer, GPS receiver, switch, and temperature sensor
2. Assembling a display and a development board that can show programmable content
3. Assembling an amplifier and a speaker with a developer board that can emit programmable sound
4. Assembling sensors (Such as switches, cameras, proximity and light sensors) that can be read by a program running on a development board

5. Writing programs that use the data collected by sensors and emit a response (Such as text on a display or a sound) based on it

Competency 6: The student will demonstrate an understanding of mechanical concepts and electric motors by:

1. Defining torque, angular speed, power, and efficiency and explain their mathematical formulas
2. Illustrate the anatomy of a motor
3. Explaining the types of motors (DC motors, steppers motors, servo motors, AC motors, linear motors)
4. Demonstrating the use of at least two types of motors and the influence of the electrical variables on their functioning
5. Writing programs that through shields on the development board that can control actuators

Competency 7: The student will demonstrate an understanding of how to prototype devices that have internet connection capabilities by:

1. Estimating the effect of location, movement, power consumption, cost, data on the product
2. Describing WiFi, Bluetooth, cellular modem, ZigBee/Z-wave, Near Field Communication (NFC), and iBeacon
3. Defining HTML, HTTP and web server
4. Modifying sample programs that use the development board as a web server
5. Modifying sample programs that use the development board as a web browser using ifttt.com

Competency 8: The student will demonstrate an understanding of how to interact with online services (through APIs and SDKs) and how to interact with sensors and actuators by:

1. Researching about network libraries, web services, and APIs
2. Writing a program that runs on a development board (Such as an Arduino or Particle) and sends a message through the Internet (such as a Tweet using Twitter) with the current temperature (or other data collected by sensors connected to the board)
3. Writing a program that runs on a development board that takes pictures with a camera or controls a motor, and it's connected with an API

Learning Outcomes:

- Use quantitative analytical skills to evaluate and process numerical data
- Solve problems using critical and creative thinking and scientific reasoning
- Use computer and emerging technologies effectively