College of San Mateo
Official Course Outline

1. **COURSE ID:** CIS 138 **TITLE:** Internet of Things
   Units: 3.0 units **Hours/Semester:** 48.0-54.0 Lecture hours; and 96.0-108.0 Homework hours
   Method of Grading: Grade Option (Letter Grade or Pass/No Pass)
   Recommended Preparation:
   Eligibility for ENGL 838 or ENGL 848 or ESL 400.
   CIS 111, CIS 254

2. **COURSE DESIGNATION:**
   Degree Credit
   Transfer credit: CSU
   AA/AS Degree Requirements:
   CSM - GENERAL EDUCATION REQUIREMENTS: E2c.Communication and Analytical Thinking

3. **COURSE DESCRIPTIONS:**
   Catalog Description:
   Introduction to the emerging platform called the Internet of Things – wherein billions of devices communicate with each other and "the cloud". Exploration of the convergence of multiple disciplines leading to modern Smartphones. Learn how information from physical devices in the real world gets communicated to Smartphone processors. Make informed design decisions about sampling frequencies and bit-width requirements for various kinds of sensors. Gain expertise to affect the real world with actuators such as stepper motors and LEDs, and generate notifications. Learn to interface common sensors and actuators to hardware. Develop software to acquire sensory data, process the data and actuate stepper motors, LEDs, etc. for use in mobile-enabled products. Apply analog-to-digital and digital-to-analog conversion concepts.

4. **STUDENT LEARNING OUTCOME(S) (SLO'S):**
   Upon successful completion of this course, a student will meet the following outcomes:
   1. Estimate sampling frequency and bit-width required for different sensors.
   2. Program GPIOs (general purpose input/output pins) to enable communication between the hardware and common sensors.
   3. Write data acquisition code for sensors such as passive and active infrared (IR) sensors, microphones, cameras, GPS, accelerometers, ultrasonic sensors, etc.
   4. Write applications that process sensor data and take specific actions, such as stepper motors, LED matrices for digital signage and gaming.

5. **SPECIFIC INSTRUCTIONAL OBJECTIVES:**
   Upon successful completion of this course, a student will be able to:
   1. Estimate sampling frequency and bit-width required for different sensors.
   2. Program GPIOs (general purpose input/output pins) to enable communication between the hardware and common sensors.
   3. Write data acquisition code for sensors such as passive and active infrared (IR) sensors, microphones, cameras, GPS, accelerometers, ultrasonic sensors, etc.
   4. Write applications that process sensor data and take specific actions, such as stepper motors, LED matrices for digital signage and gaming.

6. **COURSE CONTENT:**
   Lecture Content:
   1. IoT Concepts and Architectures
   1.1. Introduction
   1.2. Internet of Things definition evolution
   1.3. IoT architectures
   1.4. Resource management
   1.5. IoT data management and analytics
   1.6. Communication protocols
   1.7. Internet of Things applications
   1.8. Security

9.3. Anomaly detection
9.4. Problem statement and definitions
9.5. Distributed anomaly detection
9.6. Efficient incremental local modeling

10. Security and privacy in the Internet of Things
10.1. Concepts
10.2. IoT security overview
10.3. Security frameworks for IoT
10.4. Privacy in IoT networks

11. Internet of Things—robustness and reliability
11.1. Introduction
11.2. IoT characteristics and reliability issues
11.3. Addressing reliability

12. Governing Internet of Things: issues, approaches, and new paradigms
12.1. Introduction
12.2. Background and related work
12.3. IoT governance
12.4. Future research directions

13. TinyTO: two-way authentication for constrained devices in the Internet of Things
13.1. Introduction
13.2. Security aspects and solutions
13.3. Design decisions
13.4. TinyTO protocol

14. Obfuscation and diversification for securing the internet of things (IoT)
14.1. Introduction
14.2. Distinguishing characteristics of IoT
14.3. Obfuscation and diversification techniques
14.4. Enhancing the security in IoT using obfuscation and diversification techniques
14.5. Different use-case scenarios on software diversification and obfuscation

15. Applied Internet of Things
15.1. Introduction
15.2. Scenario
15.3. Architecture overview
15.4. Sensors
15.5. Gateway
15.6. Data transmission

7. **REPRESENTATIVE METHODS OF INSTRUCTION:**
Typical methods of instruction may include:
A. Lecture
B. Activity
C. Directed Study
D. Discussion
E. Experiments
F. Observation and Demonstration

8. **REPRESENTATIVE ASSIGNMENTS**
Representative assignments in this course may include, but are not limited to the following:
Writing Assignments:
Students will be required to write documentation for IoT projects.
Reading Assignments:
Assigned readings in textbook(s) and additional online readings.
Other Outside Assignments:
IoT projects done using hardware such as Arduino, Galileo, Raspberry PI, or DragonBoard and various

sensors, motors, and LEDs.

9. **REPRESENTATIVE METHODS OF EVALUATION**
Representative methods of evaluation may include:
   A. Class Participation
   B. Class Work
   C. Exams/Tests
   D. Group Projects
   E. Homework
   F. Projects
   G. Quizzes
   H. Simulation
   I. Written examination

10. **REPRESENTATIVE TEXT(S):**
Possible textbooks include:
   A. Chou, T. *Precision: Principles, Practices and Solutions for the Internet of Things*, 1st ed. lulu.com, 2016
   B. Buyya, R. *Internet of Things: Principles and Paradigms*, 1st ed. Morgan Kaufmann, 2016
   C. Ramos, R. *Internet of Things Programming with JavaScript*, 1st ed. Packt Publishing, 2017
   D. Haines, D., Salguero, G., et al. *IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things*, 1st ed. Cisco Press, 2017
   E. Pethuru, R., Raman, A. *The Internet of Things: Enabling Technologies, Platforms, and Use Cases*, 1st ed. Auerbach Publications, 2017
   F. Chin, S., Weaver, J. *Raspberry Pi with Java: Programming the Internet of Things*, 1st ed. McGraw Hill Education, 2015

Other:
   A. Arduino, Galileo, Raspberry Pi, or DragonBoard hardware

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Course Originator: Melissa Green