ACC: ACC 3

ACC Bucket: IOT -3

Course: IoT Technologies and Applications

OVERALL COURSE OBJECTIVES: This suite of Internet of Things courses aims to empower learners to design, develop, and implement comprehensive IoT systems using mobile platforms while optimizing media quality, bandwidth, and sensory processing. This includes learning to interface and program various sensors and actuators, effectively manage session initiation and termination using SIP, understanding trade-offs in media delivery, leveraging multi-sensor interfaces, conducing unit tests, and confidently configuring integrated development environments. The ultimate goal is to produce competent developers capable of bringing innovative IoT ideas to life.

LEARNING OUTCOMES: On successful completion of the course the students shall be able to:

1. Implement session initiation, management, and termination using SIP along with discovery and exchange of device capabilities.
2. Understand and apply principles of video and audio codecs used in media, addressing the tradeoffs between media quality and bandwidth.
3. Design comprehensive systems using mobile platforms that interface multiple sensors and actuators, accompanied by proper documentation and presentation of designs.
4. Develop proficiency in interfacing common sensors and actuators to the DragonBoard™ hardware and writing applications that process sensor data and take specific actions.
5. Configure at least one integrated development environment (IDE) for developing software and make usage of git, adb and fastboot to flash multiple OS and repair bricked boards.
6. Gain mastery over DragonBoard™ 410c peripherals, its I/O expansion, compute (CPU and Graphics) capabilities, connectivity capabilities, and more.

COURSE CONTENT:

Module 1: Internet of Things: Communication Technologies [6 Hours]

This course explores protocols for information exchange between processors, focusing on how "Things" communicate with each other and the cloud. It delves into how VoIP systems like Skype function and guides learners in implementing their own voice call and text message applications. The course covers the usage of the Session Initiation Protocol (SIP) for session management and voice codecs such as Adaptive Multi Rate (AMR) for voice traffic. After completion, learners will be able to implement session initiation, management, and termination using SIP, discover other users and exchange device capabilities, compare narrowband and wideband codecs, and implement VoIP calls using the DragonBoard 410c.

Sub-Topics
Codecs
Make your own VoIP application
Terminology/Cheat Sheet (Beginner)
VOIP in a Nutshell
Software Stack
Packet-switched Network
PSTN: The Traditional Phone

Formative Assessments:
3 graded quizzes.

Module 2: Internet of Things: Multimedia Technologies [5 Hours]

This course focuses on the principles of video and audio codecs used in wireless internet platforms like Snapdragon™ for media content in iTunes, Google Play, YouTube, Netflix, etc. It delves into file formats and codec settings to optimize quality and media bandwidth, ultimately guiding learners to develop a basic media player application. Upon completion, learners will be able to understand the trade-off between media quality and bandwidth for content delivery, extract and display metadata from media files, and implement a simple media player application using the DragonBoard™ 410c.

Sub-Topics
Multimedia Computing and Classification
Driving Forces in Multimedia
Codecs
Pixel Camera
Fall Risk Assessment
Computer Vision and our Application

Formative Assessments:
3 graded quizzes.

Module 3: Internet of Things Capstone V2: Build a Mobile Surveillance System [5 Hours]

In the Capstone project for the Internet of Things specialization, learners design and build their own system, incorporating a minimum of two sensors, one communication protocol, and one actuator. The project revisits and applies the knowledge acquired throughout the course. Learners can create their own system or, if they lack ideas, construct a surveillance system. The project also includes creating industry-appropriate documents such as System Design documents and Unit Test reports and demonstrating the project through a short video presentation. After completing the Capstone, learners will be proficient in designing systems using mobile platforms, developing systems interfacing multiple sensors and actuators to the DragonBoard™ 410c system, specifying and running unit tests and system tests, and making technical presentations.

Sub-Topics
Introduction

Formative Assessments:

2 Peer-review assignments.

Module 4: Internet of Things: Sensing and Actuation From Devices [16 Hours]

This course provides learners with the expertise to interface common sensors and actuators with the DragonBoard™ 410c hardware. It covers the development of software to acquire sensory data, process it, and interact with actuators, such as stepper motors and LEDs. The course also teaches how to apply both analog-to-digital and digital-to-analog conversion concepts in real-world, mobile-enabled products. By the end of the course, learners will be able to estimate the sampling frequency and bit-width required for various sensors, program GPIOs for communication between the

DragonBoard 410c and common sensors, write data acquisition code for different types of sensors, and create applications that process sensor data and trigger specific actions.

Sub-Topics
Amplifier Build
Bluetooth Remote
Course 3 Lecture series
DragonBoard™ 410c Monitoring and Control
GPIO Programming
Infrared Sensors
LED Block
Stepper Motors

Formative Assessments:
8 quizzes, and 1 Peer-review assignment.

Module 5: Internet of Things: Setting Up Your DragonBoard™ Development Platform [18 Hours]

In this course, learners build a hardware and software development environment on DragonBoard™ 410c—a single board computer (SBC), to develop skills for prototyping mobile-enabled, Internet of Things products. This beginner-friendly course covers both theoretical and practical aspects of the Internet of Things. It is ideal for anyone keen on developing mobile technology skills, shifting their career towards the design and development of IoT-enabled products, or those involved in entrepreneurial, innovative, or DIY communities. After completing this course, learners will be able to configure integrated development environments (IDEs), use git, adb and fastboot to flash multiple OS, install Android 5.1 (Lollipop) and Linux based on Ubuntu, create, compile and run a Hello World program, and understand the DragonBoard™ 410c's capabilities.

Sub-Topics
CALIT2 Bird Application
Changing your Operating System
Creating your First Application
Native Development Kit (NDK)
Rescuing your Bricked Board

Formative Assessments:

8 quizzes, and 1 Peer-review assignment.

ASSESSMENT:

For summative assessments, Coursera will provide question banks for which exams can be conducted on the Coursera platform or the faculty will create their own assessments.

Note: If a Course or Specialization becomes unavailable prior to the end of the Term, Coursera may replace such Course or Specialization with a reasonable alternative Course or Specialization.