Michigan Alliance for Greater Mobility Advancement

Course Title: Networking

Course Length: 2 days with a prior online component, online and in-person

Time Online: 6.5 hours

Time in Class: Day 1: 6.5 hours, Day 2: 7 hours (includes labs)

Time in lab: Day 1: 2 hours, Day 2: 2 hours

Class Size: Minimum 7 / Maximum 12

Price Per Student: $2,535.00

Location: Genesee County *or* Company Site

Course Description:

Understanding and using the wide variety of networking options is a critical challenge today as automotive systems continue to grow into connected and automated vehicles. This course is designed to help engineers, technicians, and managers to understand and use various networking technologies and integrate them into products and services they are required to work with or develop. Emphasis will be placed on the Internet protocols and Wi-Fi. Students will get a solid grounding in the technology and applications of Wi-Fi.

Lab Projects Description:

Lab Project 1: Interfacing an Arduino Yun to a vehicle OBD-II port to extract CAN messages.

Lab Project 2: Configuring an Android App to get vehicle status through the Arduino Yun using Wi-Fi.

Course Learning Objectives:

- Differentiate the various types of networks by type, characteristics, and applications
- Describe the Internet architecture and list with a brief explanation its main protocols
- Configure and develop experimental test plans for experimental work
- Perform experiments according to test plans
- Describe the main characteristics of HTTP, REST, TCP, IP, and Wi-Fi
- Connect to an OBD-II port and extract CAN bus messages of interest using Wi-Fi
- Configure an Android App to display appropriate vehicle information using Wi-Fi
- Articulate some current and future applications of wireless networks

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<u>Course Content/Syllabus:</u>

Online Component (throughout one week):

The course begins with a one week online component to be completed prior to classroom instruction. On this week, you'll take a Pre-Assessment to get a baseline of your understanding of the course material. After detailed information on the course, you will get a thorough overview of device and computer communications, protocols, and networks. This is followed by main applications, characteristics, and tools of the Internet. You will spend time on generating your own ideas about the role of Internet protocols and networks in several use cases. This component will end with a comprehensive assignment to be completed before the classroom instruction.

Topics:
- Knowledge Pre-Assessment
    - Welcome, Course schedule, Course collaboration tools, Learning objectives, Course syllabus.
    - Instructor, Training and delivery methodology, Assignments, Laboratories, Grading and completion criteria.
    - Introduction to course
    - Computer and device networking: Principles, architectures, protocols, networks.
    - Internet Protocols: TPC, UDP, IP, Ethernet, Wi-Fi
    - Use Cases (Main applications)
    - Networking devices: hubs, switches, routers, gateways
    - Client Server Model
    - Network Characteristics (speed, wiring, bandwidth, antennas, etc.)
    - Tools: Hardware, software

Graded Assignment
- Detailed set of questions on main Internet protocols and architectures, use-cases, characteristics, and tools.

Day 1:

On day 1 we review the online content material, answer your questions, and discuss the graded assignment of the online component. You will then get an in-depth coverage of the OSI and Internet reference models (RM) including the main Internet application layer protocols (HTTP, DNS, and REST) and distributed systems. You will then be exposed to Internet routing protocols and practical aspects of programming in Python and configuration of firewalls. You will also get an introduction to Wi-Fi. Day 1 will end with a comprehensive assignment and completing a laboratory experiment.

Topics:
- OSI Reference model (RM), Internet RM

- Application layer protocols: HTTP, DNS, REST
- Internet Distributed Systems, testing, test plans.
- Internet wired routing protocols: RIP, OSPF, IS-IS, BGP
- Internet wireless routing protocols
- Programming & Configuration: Python, Firewalls
- Introduction to Wi-Fi

Graded Assignment
- Prepare a summary of REST.
- Preparation and discussion of a test plan to perform lab project 1.

Laboratory Project 1
- Interfacing an Arduino.

Day 2:

On day 2 we review the day 1 material, answer your questions, and discuss the graded assignment and lab project of day 1. You will then get an in-depth coverage of Wi-Fi followed by a case study. You will then be exposed to the details of other important protocols and networks (IoT and Cellular). You will then work on a graded assignment and complete lab project 2. Day 2 will end with a course summary, main takeaways, a post-assessment, and a course assessment.

Topics:
- Wi-Fi: In depth
- Case Study: Connectivity in autonomous vehicles
- Other Protocols and Networks: IoT, Cellular (3G, 4G, 4G)

Graded Assignment
- Summary, comments, and conclusions of the case study.
- Preparation and discussion of a test plan to perform lab project 2.

Laboratory Project 2
- Configuring an Android App to get vehicle status through the Arduino Yun using WiFi.
- Course Summary and Wrap-up
- Course Takeaways

Knowledge Post-Assessment
- Course Assessment

MAGMA short courses are held on a rolling basis, based on industry demand. Please complete this **short form** to express interest for yourself, or your organization.