CommTECH Course 2020 Online Edition

Course Title   : Internet of Things for Smart City Applications during the Pandemic

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Time   : 3 – 14 August 2020

Synopsis

> Internet of things, or IoT, has the potential to unlock possibilities that were unthinkable in the past. Combined with technologies such as telecommunications, big data, and machine learning, IoT is set to have significant impact in many areas, such as health, transportation, smart city, agriculture, and many more. Due to the current pandemic situation, the use of IoT technology has been forecasted to further increase. In this CommTECH Course 2020 Online Edition, we will cover the three main parts of an IoT system, namely the sensor or node device, the communications network and protocol, and the web service. Participants will work in groups and be guided to have hands-on experience, with the minimum requirements of a mobile phone and computer to build prototypes and proof of concepts. In this course, we will see how IoT technology can be applied in a smart city application and combined with machine learning as a supporting technology during the pandemic.

Tentative Schedule

Time	Monday	Tuesday	Wednesday	Thursday	Friday
Week 1	Introduction & Overview	Session 1: Microcontrollers & Sensors	Session 2: LoRa & Wifi, and MQTT protocol	Sesion 3: IoT web services	Session 4: Build a telemetry system
Week 2	Session 5: Group Presentation	Session 6: Computer vision	Session 7: Machine learning	Session 8: Build a face mask detector	Session 9: Group presentation

*Please kindly note that the session will be combined with fun/cultural activities such as Fun Indonesian Language, Indonesia Virtual Dance, Surabaya Story, etc
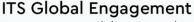
Details of sessions:

1. Introduction & Overview:
   The philosophy, potential, and general architecture of an IoT system will be discussed.

2. Session 1: Microcontrollers & Sensors
   This session deals with the sensor node subsystem of an IoT system. Basic microcontroller and sensors technology will be introduced, and programming of a simulated microcontroller with sensors will be performed as hands-on experience.

3. Session 2: LoRa & Wifi, and MQTT protocol
    The next part of an IoT is the communications layer. LoRa and Wifi are two main examples of wireless technology in IoT, and MQTT as the communications protocol will be introduced since it is among the popular protocols for IoT data transactions. Programming exercises using MQTT protocol using Python will be part of the hands-on tasks.

4. Session 3: IoT webservices
    The final component of an IoT system that is discussed is the web service that connects and processes data from all the nodes. In this session, we will cover an existing IoT platform service as the example project.

5. Session 4: Build a telemetry system
    We combine all the parts from previous sessions to build a working telemetry system through the Internet. Data visualization will be added in this session to show sensor readings in a more visually appealing manner.

6. Session 5: Group presentation #1
    Participants will present their prototypes for discussion and all groups may compete for a prize (if available). Each group should present their first telemetry prototype that is relevant to a smart city context.

7. Session 6: Computer vision
    The next part of the course will integrate more artificial intelligence aspect to the subject. In this session, we will go through the basics of using Python for computer vision using OpenCV for Python library.
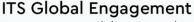
8. Session 7: Machine learning
    Using PyTorch, we will learn simple steps to perform machine learning tasks in computer vision. Due to time limitations, most if not all of the theoretical background of mathematics and deep learning theory requirements will be skipped, and a more hands-on approach will be covered. Interested participants are however highly encouraged to learn more on the subjects separately.

9. Session 8: Build a face mask detector
    By combining computer vision and machine learning, in this session we will implement a face with or without a mask detector. This is useful in the monitoring or enforcement of the compliance of people wearing face masks in public places during the pandemic.

10. Session 9: Group presentation #2
    In this session, each group present their work of a computer vision implementation that detects the number of people in a picture frame that wears face masks. Points will be given based on the detection performance: how many correct faces can be detected, what is the accuracy, and what is the speed of detection?