Summer Workshop on Cyber Security

Smart Grid Cyber Security (Part 3)

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Teaching Smart Grid Cyber Security

• Most existing courses are at graduate level.
  – Heavy use of mathematical analysis
  – Detailed analysis of different attack scenarios.

• But there is also a great need for undergraduate and college level courses in this growing area.
Course Options

• Three options:

  – Course on Smart Grid Security

  – Course on Smart Grid with Security Lectures

  – Course on Cyber Security with Smart Grid Lectures.
Course Options

• Three options:

  – Course on Smart Grid Security

  ✔️ – Course on Smart Grid with Security Lectures

  ✔️ – Course on Cyber Security with Smart Grid Lectures.
Course Options

• Course on **Smart Grid with Security Lectures:**
  
  – Use these slides as core material:

  • **Smart Grid:** Extended version of the materials in Part 1  
    (See www.ee.ucr.edu/~hamed)

  • **Smart Grid Cyber Security:** Materials in Part 2  
    (More can be added on cyber security)
Course Options

• Course on Security with Smart Grid Lectures:
  – Use these slides as core material:
    • Smart Grid: The materials in Part 1.
    • Smart Grid Cyber Security: Materials in Part 2 & More
    • Highlight the cyber-physical aspect of smart grid security!
Student Projects

• The best way to involve students in the topic.

• Various projects can be defined

  – Hardware / Software

  – Security / Privacy
Student Projects – Example 1

• Install a smart meter or at least a sub-meter
  – Several inexpensive commercial choices.

• Building, lab, home, particular equipment.

• Look for appliance signatures

• Change the reading rate to see trade-off.
Student Projects – Example 1

• Simple projects can be defined on
  – Masking signatures using renewable generation.
  – Masking signatures using batteries.
    • Charge and discharge schedules.

• Test signatures for various home appliances.
Student Projects – Example 2

• Home **Energy Management Systems:**

  – Sub-meters, RFID tags, Monitoring Software, Apps
Student Projects – Example 2

• They support monitoring and switching on/off.

• They typically use ZigBee or WiFi technologies.

• Evaluate their security and privacy features.

• Identify cyber security vulnerabilities.
Student Projects – Example 2

• Use Wireshark to do Packet Sniffing:

• Identify vulnerability for spoofing attacks.
Student Projects – Example 3

• Some PHEVs have monitoring & control Apps:

• Identify cyber security vulnerabilities.
Student Projects – Example 4

- **PMU** and **PDC** System Security Analysis:

- GPS Jamming Attacks.

- Communications Protocols and Packet Analysis.

- Data encryption (computational complexity).
Student Projects – Example 5

• Adding security features to Power Sys. Software:
  – MATPower
  – Grid-Lab-D
  – PSCAD & RSCAD
  – E-TAP
  – Etc.
Student Projects – Example 6 ...
Student Projects and Curriculum

• We can discuss your curriculum plans.

• E-mail:

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