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
      (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**:

![Image of Wireshark interface]

- **Identify vulnerability for spoofing attacks.**
Student Projects – Example 3

• Some **PHEVs** have monitoring & control Apps:

  ![Car Image]

  ![App Image]

• 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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