Course Number | CS 431 | Course Title | Cyber-Physical Systems
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Semester Hours | 3 | Course Coordinator | Henry Hexmoor

Catalog Description

The goal of this course is to introduce and develop an understanding of the computing and communication for Internet of Things as a subset of Cyber-Physical systems. Connectivity among devices in our daily lives such as WiFi-enabled thermostats, smart grids, and driverless cars is ushering in an era of sociality that transcends human social networks to machine to machine networks.

Textbooks


References


Course Learning Outcomes

- Learn the fundamentals of mathematical modeling of CPS
- Familiarize with the spectrum of analysis, testing and verification methods for CPS
- Gain basic understanding of algorithms for automatic synthesis and control of CPS
- Familiarize with modeling and simulation tools utilized in both research and industry

Assessment of the Contribution to Student Outcomes

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Prerequisites by Topic

CS 306 with a grade of C or better or graduate standing
## Major Topics Covered in the Course

1. **Modeling (15 lectures):**
   - Discrete State Models
   - Discrete State Models with Simulink/Stateflow
   - Hierarchical State Machines
   - Continuous System Modeling
   - Timed Automata
   - Hybrid Automata

2. **IoT (5 lectures):**
   - Network Protocols
   - Wireless Sensor Networks
   - Mobile Networking

3. **Analysis (10 lectures):**
   - Safety Properties for CPS
   - State-Space Exploration
   - Symbolic Verification Methods
   - Analysis of Properties of Continuous Systems
   - Reachability Analysis for Hybrid Automata
   - Temporal Logics for Verification of CPS

4. **Synthesis and Control (10 lectures):**
   - Temporal Logic Parameter Mining and Synthesis
   - Temporal Logic Synthesis
   - Model Predictive Control

NOTE: When course is taken as 500-level credit (CS 591 “Special Topics”), there will be additional requirements such as a research project.