CS596 IoT Syllabus

Introduction to Internet of Things

Silicon Valley University

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Gartner:

"World will need 300,000 IOT developers by year 2017. Anything we buy that costs over $100 will be IoT enabled by 2018"

Class

- Credit: 3
  - Lecture/Discussion Hours: 3
- Class:
  - 15 weeks,
  - 13 Lectures
  - 2 Tests (Mid Term 10/31, Final 12/19)
  - 1 Project or 1 Report
    - Hands-on Demo Project
    - Experience in Linux, C/Java or similar Computer Language useful
- References
  - More Info on Class Web

- **Audience**:
  - Seniors or Graduate Student in Computer Engineering and Computer Science
- **Scope**:
  - An overall picture and technologies introductions of Internet of Things with entry –level hands-on project demo.
  - Intensive readings of extra curriculum materials are required for project research & homework.
- **Level:**
  - Introductory/intermediate level
  - Primary initial course in IoT.
  - Fundamentals and the framework in IoT technologies.

Class Communications and Lectures

- Additional class communication is highly Internet Based: web site and email etc...
  - You're "**required**" to sign up the website and mailing list.
- Course Web Site and group email:
  - Provide your email address to SVU Admin Office to be included in the updated class roster
  - Class Web Site TBD
- Lecture Notes and Homeworks are posted on class web.

Grading (% subject to change)

ATTENDANCE /CLASS PARTICIPATION	10 %
HOMEWORK	15 %
QUIZZES	15 %
MID EXAM	20 %
IOT PROJECT	15 %
IOT REPORT	20 %
FINAL EXAM	20 %
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	115 %

RANGE OF NORMALIZED GRADES:

From	To	Rank
-	59.9	F
60.0	62.0	D-
62.1	67.9	D
68.0	69.9	D+
70.0	72.0	C-
72.1	77.9	C
78.0	79.9	C+
80.0	82.0	B-
82.1	87.9	B
88.0	89.9	B+
90.0	92.0	A-
92.1	97.9	A
98.0	100.0	A+

IoT Hardware/Design Proejct

- You can choose Hardware or Design Project
  - **Hardware Project**: Must present with IoT Hardware Implementation and code projects
  - **Design Project**: Must provide business model, application user cases and GUI layout.
- Hardware protype/demo project:
  - Pick a Hardware and Design/Implement an IoT Project
    - Arduino is best for beginner, and sensor focused project
    - Rasberry Pi 2 is more suitable for advanced programmer with Python skills
    - Intel Galileo or Beaglebone are other options
  - 6 Students per Group
  - Must present the hardware/firmware demo per group and a report per student
- Design Project:
  - 1~2 students per team. Must be in sufficient details for system implementation. → must be close to market and product specification documents.
- Final Demo scheduled for the last week before final exam
- Project Draft due three weeks before final exam (11/28).
- Project Report deadline before final exam (turn in paper report during final exam, send an electronic copy by the same time)

Misc.

- Make-up Work:
  - If you do not have Project turned in, you get zero points, period.
  - No Make-up test is allowed for mid-term and final exam. Unless you're seriously ill with doctor's proof.
  - Extra work/credit allowed for term project before final exam.
- Quiz on Homework/Assigned Readings:
  - There maybe unannounced *short quiz* on the required readings or homeworks at the beginning of class *each week*.

Connected World examples

- Wireless Sensor Networks
- Internet-connected wearables
- Low power embedded systems
- RFID enabled tracking
- Use of mobile phones to interact with the real world
- Devices that connect via Bluetooth enabled mobile phones to the
- Internet
- Smart Homes
- Connected Cars
- etc.

Class Outline

1. Introduction/IoT Overview (9/12)
   1. Definition
   2. History
   3. Eco-System
   4. Market Trend
   5. Framework
2. IoT Application Overview (9/19)
   1. Connected Car
   2. Home Automation /Smart Home / Smart Building
   3. Healthcare
   4. Smart City
   5. Smart Grid
   6. Transportation / Asset Management

Class Outline ~ continued

3. IoT Standards (9/26)
    1. Comprehensive Consortium
        1. AllJoyn/AllSeen
        2. Industrial Internet Consortium
        3. OIC (Open Internet Consortium)
        4. Thread
        5. HomeKit
    2. Smart Object ID / Labeling
        1. GS1 Oliot (Open Language of IoT)

Class Outline ~ continued

4. IoT Architecture (& Project Discussion) (10/3)
    1. Architecture Model
        1. Device
        2. Gateway
        3. Cloud
        4. Software
        5. Application
    2. Sensor Network
    3. Cloud Computing
    4. Fog Computing
    5. Addressability (Auto-ID Lab)

Class Outline ~ continued

5. IoT Sensor Technologies
    1. Sensor
    2. Actuator
    3. MEMS
    4. Properties
6. IoT Connectivities/Networks
    1. RFIC
    2. Bluetooth (802.15.4)
    3. ZigBee
    4. Z-Wave
    5. WiFi
    6. NFC
    7. Network/Connectivity Design Issues/Concerns
        1. Delay
        2. Scalability
        3. Interoperability

Class Outline ~ continued

7. IoT Hardwares / Embedded Design
   1. Open Source Hardware
      1. Arduino
      2. Raspberry Pi
      3. Beaglebone
      4. Intel Galileo
   2. Electronics 101
      1. Electronic Circuit
      2. Schematic
      3. PCB
      4. EDA: Fritzing
      5. Industrial Design
   3. Electronics Shops
      1. SparkFun Electronics
      2. Adafruit Industries, Unique & fun DIY electronics and kits
8. Mid-Term (

Class Outline ~ continued

9. IoT Protocols/Security
    1. Protocols
        1. http
        2. uPnP
        3. CoAP
        4. MQTT
        5. XMPP
    2. Security
10. IoT Softwares/Platforms
    1. IoT Web Services
        1. SOAP
        2. REST
        3. XML
        4. JSON
    2. API
    3. IoT OS
    4. Embedded System Design

Class Outline ~ continued

11. IoT Design, UX and Interface / Vertical Market Case Study (Select 1 or 2)
    1. Memory
    2. Security
    3. Privacy
    4. UI/UX
    5. Connected Device Experience
    6. Power consumption/Battery life
    7. Software updates
    8. Recovering from network failures & other failures
    9. Connectivity and communications
    10. Device Management
    11. Data collection, analysis, and actuation
    12. Scalability

Class Outline ~ continued

12. IoT and Big Data / Machine Learning /Drone
    1. Big Data
    2. Machine Learning
    3. Drone / Robotics
13. SDN Networks / IPv6
    1. SDN and IoT
    2. IPv6
14. Project Demo / Report
15. Final (12/19)