95-733 Internet of Things

Course Syllabus

Instructor: Michael J. McCarthy
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See Home Page for Office Hours

Teaching Assistant: TA: Upasna Suman
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Hours: See Canvas staff information for TA hours.

Prerequisites: 95-712 Object-Oriented Programming in Java or by permission of the instructor.

Grading Scale:
- 97.5 - 100 A+
- 92.5 - 97.4 A
- 90.0 - 92.4 A-
- 87.5 - 89.9 B+
- 82.5 - 87.4 B
- 80.0 - 82.4 B-
- etc.

Assignments:
- Four programming projects equally weighted (50%).
  One of the projects will be chosen and demonstrated by a student team.
- Quiz on readings at start of lecture with low score dropped (10%).
- Closed Book Final Exam based on readings, lectures, and programming (40%).

Late Assignment Policy:
- One assignment may be turned in late (up to one week) with no penalty. This policy is meant to cover such issues as job interviews, travel and so on. The other assignments
must be turned in on time with a penalty of 10% per day late.

Policy on collaboration:

Unless otherwise noted, collaboration is not permitted. While it is fine to discuss projects with others it is a cheating violation when code is copied or shared. If a student is caught sharing his or her work with another, a failing grade may be assigned for the course. Likewise, if a student uses another's work when completing his or her own, a failing grade may be assigned for the course. In either case, the Dean will be notified. Github submissions and past student solutions are checked. In addition, the exams are designed to test your knowledge and coding skills.

Policy on complaints about grading:

Grading mistakes may occur. Please contact the TA who graded your assignment about grading mistakes. It will be up to the TA to handle the complaint. If you are still not satisfied with the TA's grade please contact me immediately. My initial reaction will be to support the TA's grade. In some cases, however, I might agree with the student and ask for the grade to be adjusted. Please make any grading concerns known to the TA immediately. Set up an appointment with the TA and get the matter resolved.

Use of Canvas:

There will be a Canvas site for the course. Grades will be posted there and assignments will be submitted there. We will also make good use of the discussion board. It is far better to post a question to the discussion board than it is to send your instructor or TA an email. Answers posted there are available for all to see. The main site for the course (syllabus, course description and schedule) will be at www.andrew.cmu.edu/~mm6.

Software Requirements:

The student needs to download and install the most recent Netbeans IDE. Choose the "All" option at this link:


04:30PM 05:50PM HBH 1006

Time/Place:

The TA will normally be assigned to grade the projects.

Project Grading:

Please confine the use of electronic devices to class related activities.

Policy on electronic devices:

Optional Textbook:

Programming the World Wide Web, Eighth Edition
Learning Objectives:

1. Examine and critique some of the most important message formats and interaction patterns being used on the World Wide Web and the IoT.

2. Build web applications using proven developer tools and message formats. We will build web applications using technologies such as Java, Javascript, AJAX, XML, JSON, and Websockets.

3. Describe the differences and similarities between two important meta-languages - XML and JSON.

4. Explore several standards that play a significant role in the Internet of Things. We will study HTTP, MQTT, XMPP, and CoAP.

5. Examine the impact of the World Wide Web's design on the Internet of Things.

6. Consider the impact of the semantic web on the Internet of Things (JSON-LD).

7. Develop an understanding of and an appreciation for the wide variety of XML languages that are being used in many industries.

8. Gain experience developing firmware for a microcontroller.

Health:

Take care of yourself. Do your best to maintain a healthy lifestyle this semester by eating well, exercising, avoiding drugs and alcohol, getting enough sleep and taking some time to relax. This will help you achieve your goals and cope with stress. All of us benefit from support during times of struggle. You are not alone. There are many helpful resources available on campus and an important part of the college experience is learning how to ask for help. Asking for support sooner rather than later is often helpful.

If you or anyone you know experiences any academic stress, difficult life events, or feelings like anxiety or depression, we strongly encourage you to seek support. Counseling and Psychological Services (CaPS) is here to help: call 412-268-2922 and visit their website at http://www.cmu.edu/counseling/. Consider reaching out to a friend, faculty or family.
member you trust for help getting connected to the support that can help.
If you or someone you know is feeling suicidal or in danger of self-harm, call someone immediately, day or night:
CaPS: 412-268-2922
Re:solve Crisis Network: 888-796-8226
If the situation is life threatening, call the police:
    On campus: CMU Police: 412-268-2323
    Off campus: 911
If you have questions about this or your coursework, please let me know.

Last Update: August 2017. Maintained by mm6@andrew.cmu.edu
Internet of Things (6 Units) 95-733

Prerequisites: 95-712 Object-oriented Programming in Java or permission of the instructor.

Course Description: This course is designed as a programming intensive introduction to the internet of things and IoT related web technologies. We will study and build software programs primarily using Java. We will consider and work with two styles of client side programming - programming within the browser and programming stand alone clients. On the server, we will program using protocols such as AJAX and Websockets. Along the way, we will study several different markup languages. These include XHTML, RSS, RDF, JSON and JSON-LD. IoT specific technologies that will be discussed include MQTT, XMPP, UPnP and CoAP. One of our aims will be to consider how good ideas in the design of the web might be extended to include the internet of things. The primary readings in the course will come from journal articles. The prerequisite for this course is 95-712 Object Programming in Java and this is a technical course that focusses on technical problems and their solutions. However, many students, primarily interested in business problems, have also found this course to be quite valuable.

Internet of Things (6 Units) 95-733 Prerequisites: 95-712 Object-oriented Programming in Java or permission of the instructor. Course Description:
# 95-733 Internet of Things

Look for frequent updates to the topics, slides and readings.

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<thead>
<tr>
<th>Date</th>
<th>Reading(s)</th>
<th>Slides</th>
<th>Out</th>
<th>In</th>
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| **Week 1: Tuesday August 29, Thursday August 31** | Required: Enabling the Internet of Things  
Discussed in article above: URIBeacon is now Eddystone - uses existing app on your phone  
Required: Sci Am on the Internet of Things  
Required: Bruce Schneier Security of Things  
Required: Bruce Schneier Regulating the Internet of Things  
Required: Sanjay Sarma and IoT Security  
IoT Security Foundation  
IoT Security at OWASP  
Required: AJAX Article (from IBM) By Philip McCarthy  
Required: AJAX Code discussed in the article by Philip McCarthy  
Required: HTML5 WebSocket screencast from Oracle  
Required: JavaScript Object Notation (JSON) Grammar  
Introductory servlets  
Java JSON API  
Firebug  
Firebug tutorial  
Debugging AJAX  
Hello World Using JSON and AJAX  
Simple JSONP example  
General viewing: Lynda and CMU Tutorials  
General: Enterprise Integration Patterns | Introduction to course and four styles of HTTP interaction | Project 1 AJAX and Websockets Start up and Submission guide | -- |
| **Week 2: Tuesday September 5, Thursday September 7** | Working with websockets  
The Computer for the 21st Century  
Required: Photon Kit | Enabling the Internet of Things  
Asynchronous Javascript and XML | Quiz 1 start of class on Tuesday on article: Enabling the Internet of Things | -- |
| **Week 3: Tuesday September 12, Thursday September 14** | MQTT Tutorial  
Required: Smart, connected products  
Internet of Things Landscape  
People, Places, Things: Web Presence for the Real World | MQTT Connected Products and Microcontrollers | Quiz 2 start of class on Tuesday on article: The Computer for the 21st Century | Project 1 Due Tuesday Midnight |
| Week 4: Tuesday  
| September 19, Thursday  
| September 21 |
|-------------------|-----------------|-----------------|
| **Sensor Andrew - Large Scale**  
| **Campus Wide Sensing**  
| **CoAP Tutorial**  
| **Constrained RESTful Environments**  
| **IPSO Alliance**  
| **Open Mobile Alliance**  
| **Introduction to XMPP**  
| **IoT Integration Patterns, REST, and CoAP**  
| **Quiz 3 start of class on Tuesday** on article: People, Places, Things: Web Presence for the Real World |

| Week 5: Tuesday  
| September 26, Thursday  
| September 28 |
|-------------------|-----------------|-----------------|
| **From the Internet of Things to the Web of Things: Resource Oriented Architecture and Best Practices**  
| **Web of Things**  
| **Web of Things Video**  
| **JSON-LD video**  
| **Raspberry Pi Demo**  
| **Google, Yahoo, and Bing support Schema.org**  
| **TBL and the Semantic Web**  
| **TBL and Linked Data**  
| **Linked Data at Nature**  
| **A List Apart on RDFa**  
| **Google's Use of RDFa**  
| **Best Buy uses RDFa for eCommerce**  
| **What is RDF?**  
| **RDFa**  
| **Introduction to RDF**  
| **Quiz 4 start of class on Tuesday** on Sensor Andrew: Large-scale campus-wide sensing and actuation |

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<th>Week 6: Tuesday October 3, Thursday October 5</th>
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<td><strong>Final Exam (Closed book, Closed notes) Canvas Based - Review for final exam</strong></td>
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<th>Week 7: Tuesday October 10, Thursday October 12</th>
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<td><strong>Final Exam (Closed book, Closed notes) Canvas Based - Review for final exam</strong></td>
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| Week 8: Tuesday October 17  
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<th>Final Exam held during normal class time and place.</th>
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<td><strong>Final Exam (Closed book, Closed notes) Canvas Based - Review for final exam</strong></td>
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Last Update: May 2017