SIE558 Real-time Sensor Data Streams

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Contact Information:
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Office Hours:
Office hours for this course will be announced at the beginning of the semester. Alternatively, contact me.

Credits: 3
Prerequisite: Graduate standing, SIE 555, programming experience in Java, C++, or C

Catalog description
This course is an introduction into the technology of sensor data stream management. This data management technology is driven by computing through sensors and other smart devices that are embedded in the environment and attached to the internet, constantly streaming sensed information. With streams everywhere, Data Stream Engines (DSE) have emerged aiming to provide generic software technology similar to that of database systems for analyzing streaming data with simple queries in real-time. Sensor streams are ultimately stored in databases and analyzed using scalable cloud technologies.

Topics covered:
• Introduction to sensor data stream management systems
• Data stream engine software
• Data model and query language concepts
• Stream query processing
• Stream query optimization techniques
• Adaptive stream query processing techniques
• Real-time sensor data stream management
• Historic sensor stream management in the cloud
Course outline

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<th>Week</th>
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| week 1   | Organizational meeting  
Literature Search  
Introduction to Sensor Stream Management. |
| week 2   | Visions and Overviews.  
Prototype Stream Systems. |
| week 3   | Stream Data Model Languages.. |
| week 4   | Query Languages.  
Semantics and Stream Query Processing. |
| week 5   | Stream Query Processing  
Stream Query Operators |
| week 6   | Stream Query Processing  
Query Optimization |
| week 7   | Query Processing and Constraints  
Adaptive Query Processing/Migration |
| week 8   | Scheduling of Operators and Queries  
Approximation/Sampling/Estimation |
| week 9   | Sensor Data Management  
Sensor Applications |
| week 10  | The Field as Data Type for Big Spatial Data I  
The Field as Data Type for Big Spatial Data II |
| week 11  | THANKSGIVING BREAK |
| week 12  | Big Sensor Data Management in the Cloud I  
Big Sensor Data Management in the Cloud II |
| week 13  | Integrating live Sensor Streams with Historic Streams |
| week 14  | FINAL PROJECTS |

Textbooks:
Real-Time Analytics: Techniques to Analyze and Visualize Streaming Data,  
Bryon Ellis, Wiley 2014  
Data Stream Management (Synthesis Lectures on Data Management), Lukasz  

Software:

We will use the Apache Storm data stream engine platform.

Course Goals and Objectives

- Introduce students to central concepts of data stream management concepts, applications, and programming
- Develop an understanding of data stream processing and optimization
- Learn in particular new advances in the subject areas of sensor and stream data management systems.
• Develop skills needed to critically analyze technical literature.
• Get practice designing a research or application project related to stream or sensor data management.
• Practice skills to communicate your ideas to an audience in a presentation or a scientific discussion.

Learning outcomes:

Upon completion of this course, students should be able to:

• Explain the differences and similarities between traditional database systems and stream engines.
• Describe the different components, including their underlying principles and algorithms, of a stream engine.
• Design and develop a stream- or sensor-related database project.
• Gain skills in understanding, programming and applying data stream engine technology.

Grading, Class Policies and Course Expectations

As a graduate level course, you are expected to exhibit high quality work that demonstrates sound understanding of the concepts and their complexity. Earning an “A” represents oral and written work that is of exceptionally high quality and demonstrates superb understanding of the course material. A “B” grade represents oral and written work that is of good quality and demonstrates a sound understanding of course material. A “C” grade represents a minimally adequate completion of assignments and participation demonstrating a limited understanding of course material.

Grading criteria:

Homework assignments (programming, paper presentations) – 50%
Class participation – 10%
Final Project (programming project and presentation) – 40%

Academic honesty

Academic honesty is expected. Plagiarism—one form of academic dishonesty—is the handing in of work not substantially the student’s own. It is usually done without reference, but is unacceptable even in the guise of acknowledged copying. It is not cheating, however, to discuss ideas and approaches to a problem, nor is it cheating to seek or accept help with a program or with writing a paper. Indeed, a moderate form of collaboration is encouraged as a useful part of any educational process. Nevertheless, good judgment must be used, and
students are expected to present the results of their own thinking and writing. Plagiarism is unacceptable in this course and will result in a failing grade.

**Students with disabilities:**

If you have a disability for which you may be requesting an accommodation, please contact Ann Smith, Coordinator of Services for Students with Disabilities (Onward Building, 581-2319), as early as possible in the term.

**Extended disruption:**

In the event of an extended disruption of normal classroom activities, the format for this course may be modified to enable its completion within its programmed time frame. In that event, you will be provided an addendum to the syllabus that will supersede this version.

**UMaine's Sexual Discrimination Reporting:**

The University of Maine is committed to making campus a safe place for students. Because of this commitment, if you tell a teacher about an experience of sexual assault, sexual harassment, stalking, relationship abuse (dating violence and domestic violence), sexual misconduct or any form of gender discrimination involving members of the campus, your teacher is required to report this information to the campus Office of Sexual Assault & Violence Prevention or the Office of Equal Opportunity.

If you want to talk in confidence to someone about an experience of sexual discrimination, please contact these resources:

- For confidential resources on campus: Counseling Center: 207-581-1392 or Cutler Health Center: 207-581-4000.
- For confidential resources on campus: Rape Response Services: 1-800-310-0000 or Spruce Run: 1-800-863-9909.
- The following resources on campus can offer support but may have to report the incident to others who can help: Office of Sexual Assault & Violence Prevention: 207-581-1406, Office of Community Standards: 207-581-1409, University of Maine Police: 207-581-4040 or 911.

See the OSAVP website for a complete list of services at http://www.umaine.edu/osavp/