Advanced Topics in Internet of Things
Lecture 1 – Introduction
(Course Organization)

Klara Nahrstedt
Fall 2022
Overview

- Course information
  - Personnel
  - Policy
  - Schedule
  - Grading
  - Projects Discussion
Instructor Introduction

Klara Nahrstedt

- PhD 1995 from Department of Computer and Information Science, University of Pennsylvania

Research:

- Networking (routing, QoS management, pricing),
- Multi-modal Distributed systems (overlay multicast, peer-to-peer systems, service composition, resource management),
- Mobile computing – smart phones protocols – P2P, video streaming over mobile phones, group management, …
- Operating systems (soft-real-time scheduling, caching),
- Multimedia applications (multi-view 3D tele-immersive systems, multi-camera systems, collaborative environments, mobile multimedia, P2P IPTV, multi-view 360 Video Streaming)
- Multimedia and critical infrastructure security (watermarking, real-time security)
- Cloud computing/Edge Computing
- Internet of Things
Course Logistics

Office Assistant:

- Candice Steidinger (steidin2@illinois.edu)
- If you need to meet with me outside of office hours, please ask Candice for an appointment. She has access to my calendar and will help you very fast.

Teaching Assistant: no TA

- Any questions you have, please, email
  - Instructor klara@illinois.edu with subject line “CS537"

Class Time: Tuesday and Thursday 12:30-1:45pm

Class Place: 1302 Siebel Center

Zoom link will be available as well (in case of COVID infections)
Course Logistics

Instructor Office Hours:
- Time: Tuesday and Thursday 2:00-3:00pm CST
- Place: 3104 SC (masks recommended)
- Zoom will be available (upon demand)
- Phone: 217-244-6624

Class Website – Reading List will be posted on September 25, 2022

Discussion, Announcements, and Postings:
- Campuswire app (please, check that you received invitation, can access and post on campuswire app)

Grading Center: Canvas
Required Readings for CS 537

- Papers in Reading List
  - Papers will be posted around September 25
    - https://courses.grainger.illinois.edu/cs537/fa2022

- Lectures and Discussion in class
  - Papers in class plus optional papers
Other Readings for CS 537

**IoT Books and Papers**

- “Internet of Things and Big Data Analytics”, Edited by P. Raj et al, CRC Press, 2020
- “Analytics for the Internet of Things (IoT)”, Andrew Minteer, Packt Publishing, 2017
- …. Many conference and journal papers from ACM and IEEE professional orgs
  - ACM IOTDI (Internet of Things Design and Implementation)
  - ACM IPSN (Information Processing of Sensor Networks)
  - IEEE MASS (International Conference on Mobile Ad-Hoc and Smart Systems)
  - ACM/IEEE CPS-IOT Week, (other symposia)
  - ACM SEC (Symposium on Edge Computing)
  - ACM SenSys
  - Many conferences on cloud computing (e.g., ACM SoCC – Symposium on Cloud Computing)

**Multimedia/Immersive Computing Books and Papers**

- … many other conference and journal papers from ACM and IEEE professional orgs
  - ACM International Conference on Multimedia,
  - ACM MMSys (Multimedia Systems)
  - ACM ICMR, (International Conference on Multimedia Retrieval)
  - IEEE ICME (International Conference on Multimedia and Expo)
  - IEEE CVPR (International Conference on Computer Vision and Pattern Recognition)
  - IEEE ICASSP (International Conference on Acoustics, Speech, and Signal Processing)
  - ACM and IEEE TMM (Transactions on Multimedia)
  - ACM SIGGRAPH
Course Prerequisites

- It is helpful if you have taken at least one of these classes in your undergrad studies:
  - CS 425 (distributed systems undergrad) and/or
  - CS 438 (networking systems undergrad)
  - CS 437 (Internet of Things systems undergrad)
  - 400-level computer vision class
Goal of the Course

- **Expand breath of knowledge** in the area of multi-modal IoT systems through
  - Learn new Multi-Modal IoT-specific system and networking concepts
  - Learn new mathematical and design tools to model and design complex systems that run multi-modal IoT systems

- **Learn scientific tools for your MS/PhD theses**
  - Learn how to evaluate scientific papers
  - Learn how to prepare and present a scientific work as lecture
  - Learn how to present related work
  - Learn how to prepare project proposal
  - Learn how to prepare project presentation and final project report
Class Format

Class will consist of partially
- lecturing by instructor, guest lecturer and
- lecturing by students based on reading list
- paper discussions

Students' responsibility
- Attend lectures
- Read papers!!
- Work on presentations, take-home midterm exam, project, lectures
- Look for new material and post on campuswire when you find interesting papers, tools, other material to share
Workload (1)

Lecturing and Q&A

- Student presents paper(s) (1-2 papers) – depending on the size of class by September 25
- There will be a sign-up sheet to sign up for presentation(s)

- Instructions regarding sign-up sheet and selection will be placed on campuswire.

- Paper assignment will be on a first-come-first-serve policy
  - Student presents the papers synchronously
  - Instructor evaluates the lectures, and discussions
Workload (2)

- Take-Home Midterm Exam
  - Questions will be asked from Lectured material and papers presented prior to exam
  - Problems will include material covered in papers and lectures to answer the midterm questions
Workload (3)

- **Final project** will include three parts:
  - 1. project proposal
  - 2. project presentation in class
  - 3. project paper
Lecturing

Each student needs to present paper(s)

- Each student selects choice of papers in sign-up sheet
  - Details about sign-up sheet will be posted on campuswire
  - Selection of papers will be based on First Come First Serve
  - Assignments will be posted on the class website in the Reading List

The sign-up sheet will open on September 25 and close on September 27, 2022
Lecture Format for Papers’ Presentation

- Paper presentation should be **20 minutes maximum** to leave at least 10 minutes for discussion.
- You should plan 1-2 minutes per slide, so having around 15-20 slides.
  - Use simple strong contrast colors.
  - Do not make the slide too busy.
- **Post your slides on campuswire before lecture or send it to instructor.**
Lecture Format (2)

Your presentation should include

- Motivation of the problem (why are we looking at this issue? What is the environment where the problem resides?)
- Problem Description (What is the problem and what are the challenges of the problem?)
- Background (How did other people solve this problem and why isn’t this enough?)
- Novel approach (solution described in the paper)
- Validation of approach
- Conclusion with Pros and Cons of Paper
Take-Home Midterm Exam

- Midterm exam will be
  - Posted on October 24 (Monday 11:59pm)
  - Due on October 31 (Monday 11:59pm)

- Use lectures, web material and papers to find answers

- Submit midterm-exam solutions in pdf format to klara@illinois.edu, subject line: “CS537 – Midterm”
Final Project (1)

- Each student must work on a **class project** in multi-modal/IoT system/network area
  - Consider continuation of your research projects if it has IoT context
  - Consider exploring new topic towards your research
  - Come and see instructor during office hours if you need suggestions for class project (or setup a meeting via Candice with the instructor)
  - You can work **alone**, or in **group of 2-3 students**
    - Depending on the size of the project group, corresponding complexity of the project and clear division ‘who does what’ is required and expected.
Final Project (2)

- The project should have research flavor (so no survey for final project)
- You are encouraged to
  - develop new algorithm/protocol and/or application and/or
  - improve existing algorithm/protocol/application and
  - validate via comparative simulation or real implementation
  - run QoE experiments on Video 360 and other IoT data
  - develop analysis tool for public IoT data
  - evaluate/measure existing multi-modal IoT system/tool
  - evaluate existing analytics tools on existing IoT data
  - …..
Project Proposal Format (1)

Format:

- ACM format, single column, font 11 Arial (or Times New Roman), pdf
- Specify name, title, class number
- Length: 4 pages;

Proposal: Introduction

- Motivation and description of problem
  - explain why it is a problem
  - How did others solve the problem?
  - How do you plan to solve the problem?
  - What is broader impact of your solution?
Project Proposal Format (2)

Proposal: Possible Approaches you consider to take
- Picture of framework/architecture you want to explore
- Algorithm you want to explore and compare/improve
- Experiment(s) you want to conduct

Proposal: Action Plan
- By when you want to do what?

Proposal: References
- Papers you want to read and use in your research (at least 3 references must be included – read related work before you propose a project)
Project Presentation and Report Formats

- **Presentation format** should be similar to the lecture format
  - Talk about your problem, challenges, solution and validation.
  - Conclude with lessons learned

- **Report format** should be written like a scientific conference/workshop paper in ACM format (available on web)
  - Read and review papers carefully
Project Deadlines

- **Project Proposal**: October 10 (Monday), 11:59pm
  - Submit to klara@illinois.edu
  - Subject: cs537: Project proposal

- Meet with Instructor for **Project Proposal feedback**:
  - October 11 and 13, 2-3pm (Office Hours)
  - October 14: 3-6pm
  - Sign-up sheet will be provided
Project Deadlines

- **Project Presentation:** November 29, December 1 and December 6
  - Sign-up sheet will be available
  - Depending on number of project, time slots will be allocated
    - Depending on number of students in the class, number of project in the class, we will inform each group about the allotted presentation time.
Project Deadlines

- **Final Project Report** Deadline: December 14, 11:59pm (Wednesday)

- Depending on the size of the project group
  - 1 person project: min **6 pages** – double column ACM Format paper (with references, pictures, tables)
  - 2 person project: min **8 pages** – double column ACM Format paper (with references, pictures, tables)
  - 3 person project: min **10 pages** – double column ACM Format (with references, pictures, tables)
Facilities and Equipment

- Engineering workstations-linux machines
- Use laptop cameras or mobile phones cameras or just images/videos on Internet
- Software: gstreamer, ffmpeg, GPAC, kvazaar (HEVC encoder), MATLAB, Jupyter Notebook, Phyton, Graphana, MQTT (and other pub/sub systems), other IoT and vision software packages
- If you have any further questions regarding the software, please, contact instructor
  - More software can be installed based on project demands – email for help to engrit-help@illinois.edu (and instructor)
  - Any problems with engineering workstations/multi-modal software – email for help to engrit-help@illinois.edu (and instructor)
Grading

- Take-Home Midterm Exam: 35%
- Paper(s) Presentation: 15%
- Final Project: 50%
  - Project Proposal (5%)
  - Project Presentation (15%)
  - Project Final Report (30%)
Grading policy

- Gradebook system: TBD
- It is your responsibility!
  - Check announcements in lectures, campuswire, or class website
  - Please, email to instructor
Re-grading policy

- Students have 1 week (after the grade is released into the gradebook) to request for re-grading
- Re-grading requests need to be in writing to the instructor
- After the re-grading period, no re-grading request will be granted.
Summary

- Any questions you may have, please, email to
- Instructor: klara@illinois.edu

- Have a great semester Fall 2022!