[M1522.002600] Advanced Mobile Computing

Success is not final
Failure is not fatal
It is the courage to continue that counts.

Winston Churchill

Instructor

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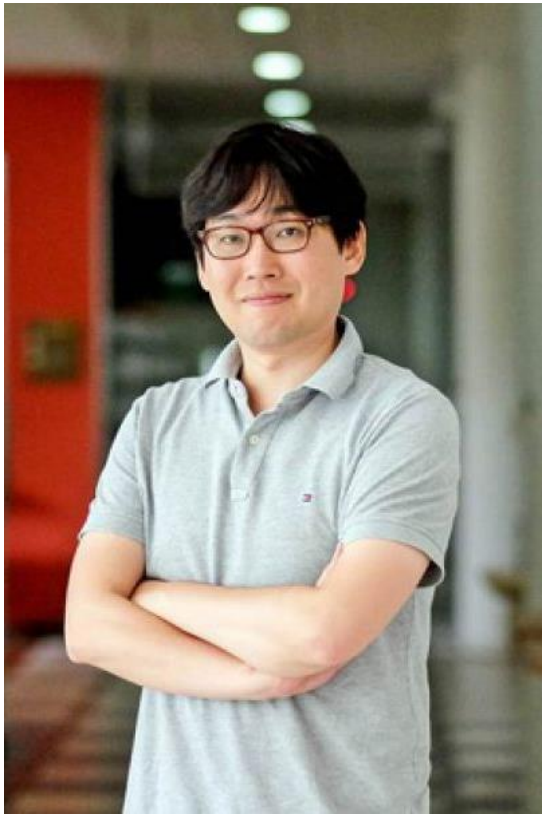


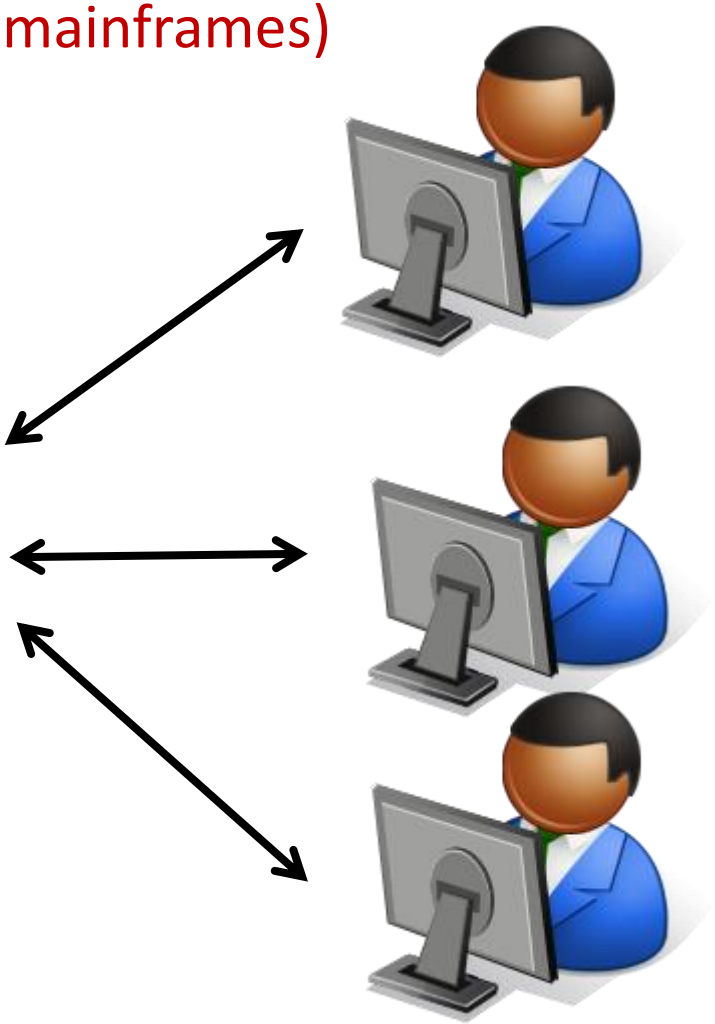
Today's Agenda

- Introduction to Mobile Computing
  - Evolution of Computing
  - Life-Immersive Mobile Computing
- Course Introduction
- Course Project Introduction

Mobile Computing: Where Are We?

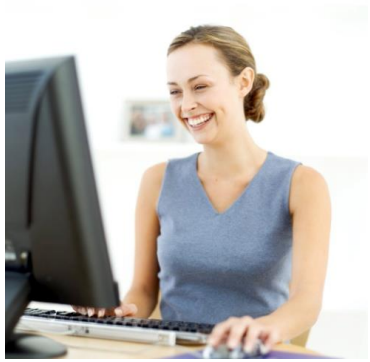
Progression of Computing #1

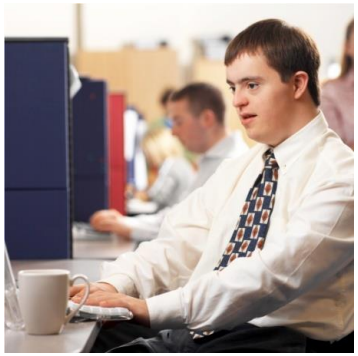
- Before the early 80s
  - Centralized computation (mainframes)



Progression of Computing #2

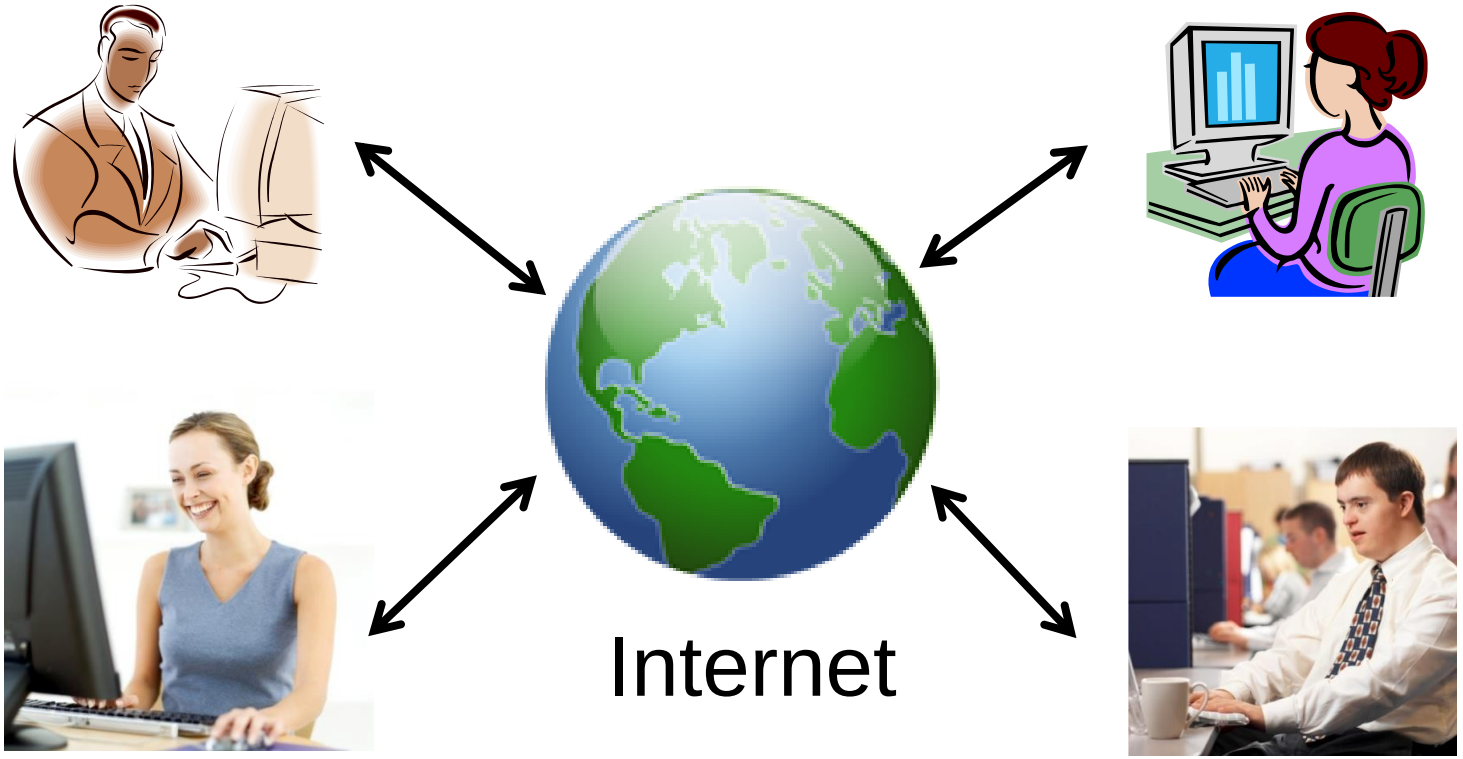
- 1980s – mid 1990s
  - Personal desktops; no shared environment; asynchronous messaging.



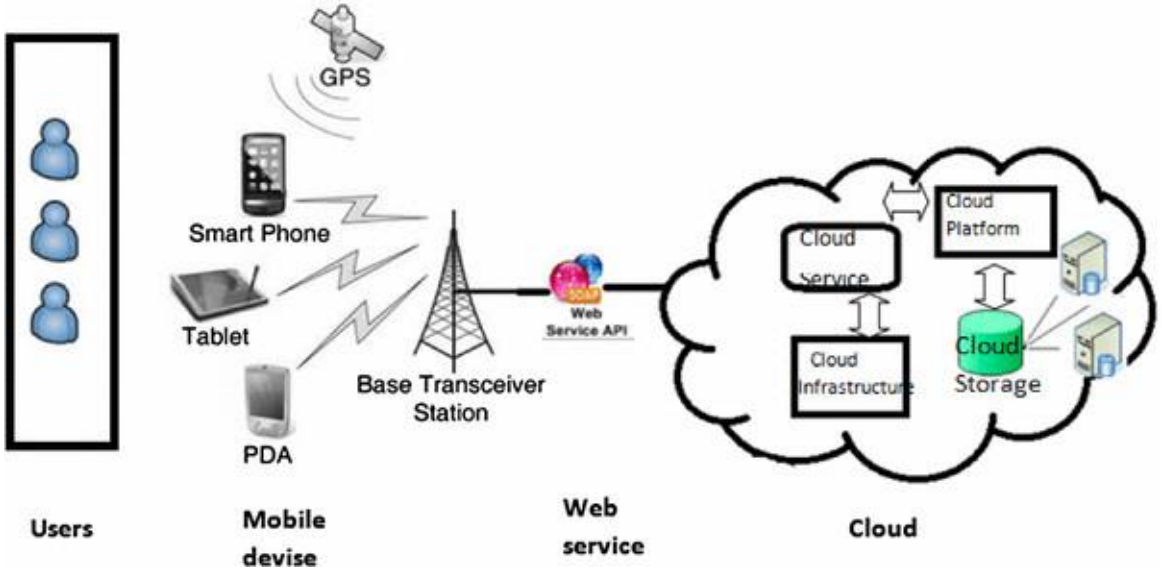
Progression of Computing #3

- 1990s – 2000s
  - Interconnected computing; real-time communications; distributed “network”



Progression of Computing #4

- 2010 – now
  - Mobile devices; use of cloud-hosted services, significant two-way traffic.



Mobile Devices

Feature Phone

HW oriented, Communication centered

Smartphones iPhone, Android

New Mobile Interface User satisfaction

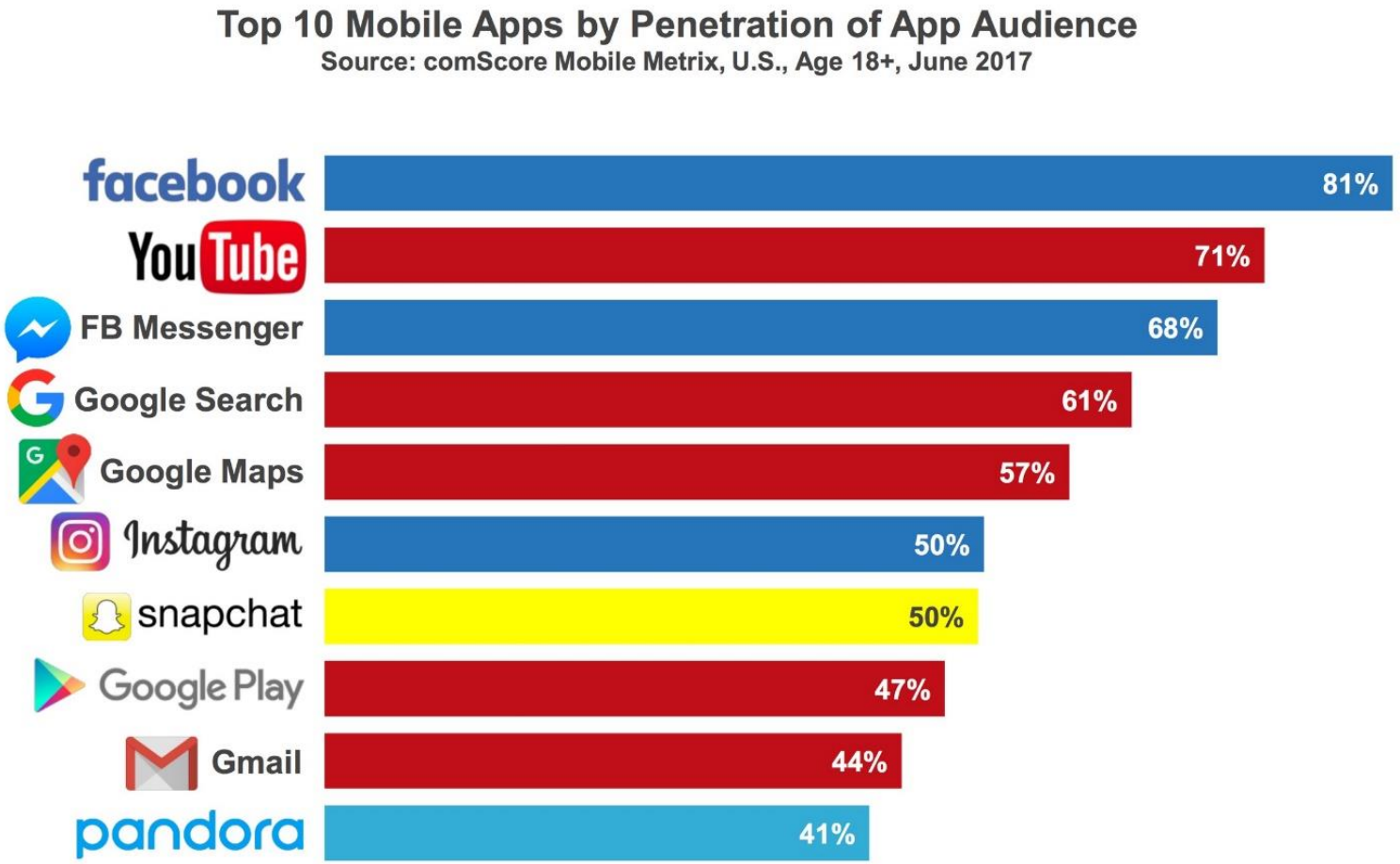
New Wearable/IoT Devices

???

Mobile “Computer”?

Is mobile computing really different from previous computing paradigms?

It may be True.



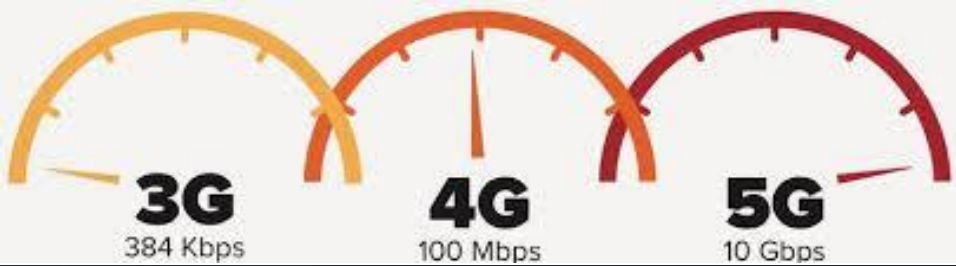
Android Platform

- https://developer.android.com/guide/platform/?hl=ko

Common Perception 1

Mobile computing is all about mobile network !

Advance in Cellular Networks



1980s	1990s	2000s	2010s	2020s
				
1G	2G	3G	4G	5G
Analog Voice	Digital Voice	Mobile Broad Band	Better and Faster MBB	A Connected World
AMPS TACS	GSM, CDMA	WCDMA CDMA2000 TD-SCDMA WIMAX	LTE LTE-A 4.5G	5G


mmWaves
MiMo
Beam Forming
D2D
Ultra-Low Latency
INTERNET of THINGS

Advance in WiFi

Protocol	Frequency Band	Compatibility	Theoretical Rate	Actual Rate
802.11a	5 GHz	N/A	54 Mbit/s	About 22 Mbit/s
802.11b	2.4 GHz	N/A	11 Mbit/s	About 5 Mbit/s
802.11g	2.4 GHz	Compatible with 802.11b	54 Mbit/s	About 22 Mbit/s
802.11n	2.4 GHz, 5 GHz	Compatible with 802.11a/b/g	450 Mbit/s (three spatial flows)	About 80 to 220 Mbit/s
802.11ac	5 GHz	Compatible with 802.11a/n	1300 Mbit/s	250 Mbit/s to 400 Mbit/s

[802.11 ax]

10 Gbps

2.4 / 5GHz band

High-efficiency wireless

[802.11 ay]

20-40 Gbps

~300 m range

60GHz band

Connecting buildings

802.11

[802.11 ah]

300 Mbps

900MHz band

Connecting IoT devices

[802.11 af]

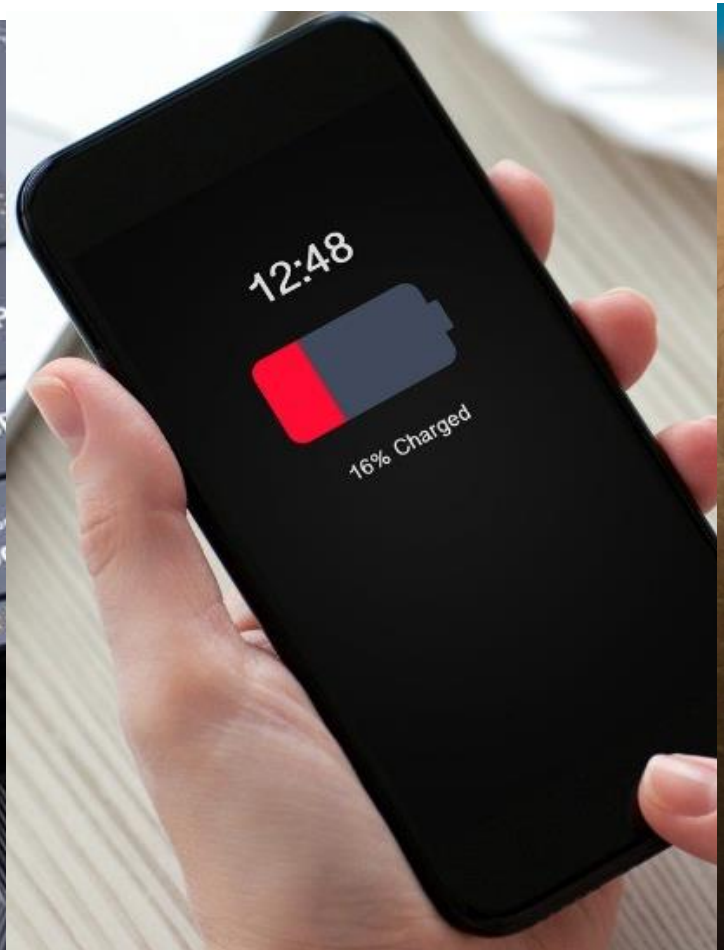
54/790 MHz band

(Whitespace)

Long-range connectivity

Common Perception 2

- A mobile device is a small resource-constrained computer.



Nike+iPhone?

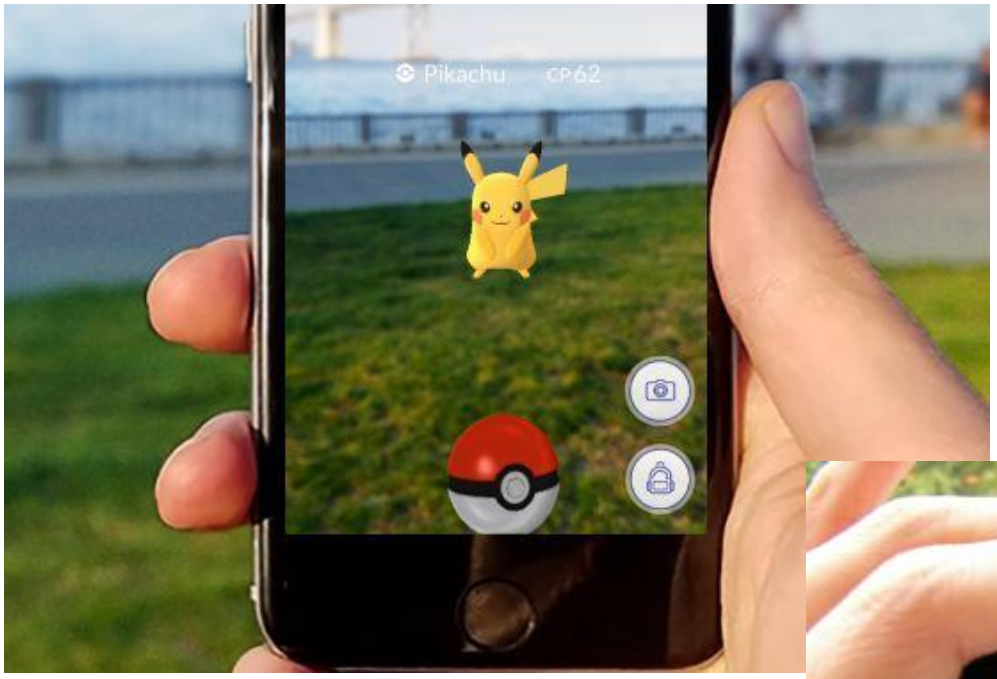

iPod Nano를
넣도록 디자인된
운동복
깔창 밑에
들어가는 센서
iPod에 붙는
무선 Interface
NIKE + IPOD


REAL FEEDBACK
IN REAL TIME


SYNCHRONIZE WITH THE COMPUTER


VIEW PROGRESS

PokeMon Go and AR-Navigator?



Life-Immersive Mobile Computing

Tightly integrated with **real-world** situations

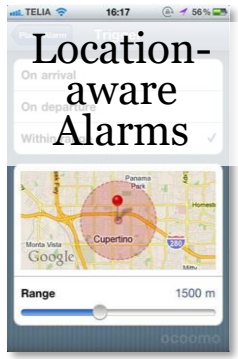
Continuously monitor **ourselves** and our **real-world** situations

Provide what we need **right on time & place**

Sleep Quality Monitoring

Physical Activity Diary

Pothole Monitoring



Location-aware Alarms

Bus Stop Queue Estimation

Smart Vibration

Auto-Silencing My Phone

Proactive Advertisement

Life-Immersive Mobile Computing

- It becomes extremely important to understanding users and their experiences in real-life situations.
  - Design systems and technology from user experiences.
- EXPERIENCE design vs. LOGIC design
  - Problems can't be easily defined due to the diversity of the users and complexity of situations.
  - Understanding design spectrums and making the right design decisions become more important.
- Roles of computer scientist and engineers go beyond design the logic or systems.
  - This is also far beyond supporting human-computer interaction.

Course Objectives

- Upon completion of the course, you should be able to:
  - Design and develop a mobile application and system to enable new / enhanced user experience.
  - Understand new concepts and state-of-the art technologies in mobile and ubiquitous computing.
  - Build soft skills – for example, critiquing technology and share ideas in a constructive manner.

Why Do I Need to Take This Course?

- Most of you will be involved in software projects as an engineer or an entrepreneur.
  - Many solutions involve mobile and pervasive computing technology.

- Help your graduate study and research.
  - Students will learn lots of soft skills that are important for graduate studies such as paper reading, critiquing, and presentation.
  - Students can spin off a mobile computing-related research projects.

Class Timings

- Day: Tuesday and Thursday
- Time: 3:30PM – 4:45PM
- Office Hour
  - Thursday 4:45 PM – 5:00 PM
  - Feel free to stop by besides office hours. You may want to make an prior appoint by email if you must see me.

Pre-Requisites

- Assume that you have an undergrad degree in computer science or other related field.

- You should be able to self-learn development of mobile applications.
  - If you are aware of Java and Linux, it should not take too long to program on Android.

Textbook

- There is no textbook.

- We will use lecture slides and research papers.

Make-Up Classes

- June 6 (Memorial Day) – Week 14

- Make-up class.
  - We will schedule one more slot on week 15 or 16 and use it for the final exam.

Tentative Lesson Plan

Week	Lecture Topic	Project Deadlines
1	Class Intro & Intro-to Mobile Computing	
2	Human Behavior and Context Sensing/Analytics: Activities	
3	Human Behavior and Context Sensing/Analytics: Activities	
4	Project Proposal and Feedback	March 25 Monday [11:59pm]. Push the final proposal slides (in git repo)
5	Human Behavior and Context Sensing/Analytics: Locations	
6	Human Behavior and Context Sensing/Analytics: Locations	
7	Human Behavior and Context Sensing/Analytics: Emotions and Health	
8	Human Behavior and Context Sensing/Analytics: Emotions and Health	
9	Special Topics	
10	Project Review and Demonstration of Initial Prototype	May 6 Monday [11:59pm]. Push the review slides and apk for the demo prototype (in git repo)
11	Mobile and Embedded Machine Learning Systems: Basics	
12	Mobile and Embedded Machine Learning Systems: Power and Optimization	
13	Mobile and Embedded Machine Learning: Cloud and Edge	
14	Mobile and Embedded Machine Learning: Privacy and Other Issues	
15	Project Final Presentation and Demo	June 10 Monday [11:59pm]. Hard deadline. code, final apk, final presentation slides in git.
15/16	Final Exam	TBD

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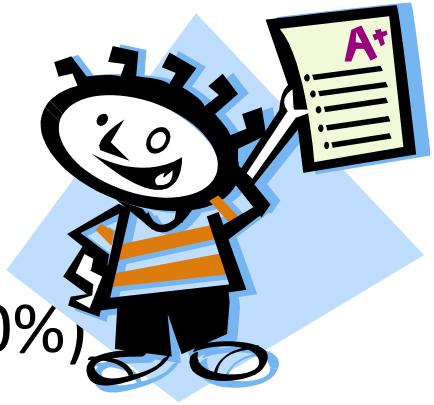
Assessment



- Presentation and Class Participation (20%)
  - Presentation & Discussion:10 %
  - Paper Critique: 10 %
- Project (40%)
  - Presentations
  - Novelty of the idea
  - Process of the development
  - Quality of the final application / research paper
- Final Exam (40%)
  - Scope: Lecture materials and papers in the reading list.
  - No official textbooks.

Class Format (Regular Weeks)

- Tuesday: I will give the overview of the topic of the week.
- Thursday: Teams are expected to present papers in the reading list on the topic of the week.
  - 20 minute presentation + 15 minute discussion.
  - Each team will present two papers throughout the semester (one in the first half and another in the second half).
  - All students are expected to read the papers in advance, submit critique for one paper, and be ready for the discussion.
- Week 1 (Intro), Week 9 (Special topics) and project presentation weeks (Week 4, 10, 15) are excluded.

Paper Presentation

- Reading list is available at: https://goo.gl/cdqR89
- Pick the paper you want to present and sign up here: https://goo.gl/QegLWv
- First come first served.
- We will improve on reading and presenting papers along the way, but you can start with the following paper.
  - How to Read a Paper, S. Keshav
    [ACM SIGCOMM Computer Communication Review, ’07]

Class Participation

- "Delivering an interactive, participative and warm learning experience"

- You (as a student)
  - Be prepared for class (read papers)
  - Have a positive impact on collaborative learning
    - Contribute and share what you know
    - Discuss and work in a team
  - Be professional
    - No hijacking the airwaves
    - Give due respect to your peers (listen when they talk)

- I (as the instructor)
  - Our responsibility and professional duty to assess you
  - I will give the final score based on my careful observation during class

Name Tags

- Print your name on both sides
- Names must be readable from anywhere in class

Course Policies: Attendance

- Fail the course if you miss more than 3 classes without valid reasons (MC, official school events, attending conferences, etc.)
- All excuses should be given promptly and in advance (whenever possible)
- Submit MC or other proof to TA within a week

Course Policies: Submission

- If you are the presenter on Thursday in Week X, post your presentation slide to etl by Wednesday midnight in Week X.

- Everyone should submit a hard copy of your critique for a paper to be presented to TA before our Thursday class.

- Critique should include the problem, solution approach, 3 weak points, 3 strong points, and your new idea to solve the problem in a better way.

Course Policies: Submission

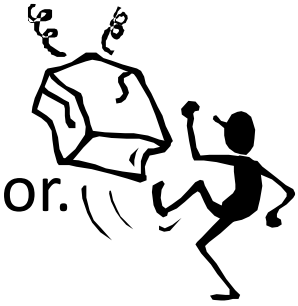
- Submit ALL project-related deliverables through GIT.
  - I will use Git push timestamp as the submission time.
  - Make sure the directory structure inside your GIT repo is easy to understand. A “Readme” file will be useful too.

- Late submission will not be allowed as you need to demo and present to your class.

Course Policies - Academic Integrity

- All acts of academic dishonesty (including, but not limited to, plagiarism, cheating, fabrication, facilitation of acts of academic dishonesty by others, unauthorized possession of exam questions, or tampering with the academic work of other students) are serious offences.

- All work (whether oral or written) submitted for purposes of assessment must be the student's own work. Penalties for violation of the policy range from zero marks for the component assessment to expulsion, depending on the nature of the offence.



- When in doubt, students should consult the instructor.

Most Importantly …

- Work hard but have fun!