CS407: Foundations ofcMobilevSystems and Applications (Spring2017)

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Summary of course content

Smartphones have taken the world by storm. These devices have significantly expanded capabilities that have transformed user experience and behavior. As users continue to depend on these smartphones for their daily activities, a large range of applications and services continue to emerge. Application stores are gaining in popularity and every day many new applications are being available for download targeting these mobile phones. Smartphones form a unique class of devices requiring new way of application design. They are characterized by limited processing, memory and storage capabilities; mobility across different types of networks (untrusted WiFi hotspots, various cellular data services) that have intermittent connectivity in some cases; a different user interface (touchscreens, gestures, and limited keyboards); and limited battery power. They are multi-function in nature and often come equipped with a large array of sensors — cameras, accelerometers, touch capabilities, GPS, and even electronic compasses. Usage models for these devices are also quite unique with people using them as personal digital assistants, as notetakers, as alarm clocks, as cameras, and sometimes as a mainstream computing platform. Hence, the considerations for designing applications and services are significantly different. This course will explore efficient strategies to design and implement applications and services for this emerging class of mobile phone platforms. The course will start with an overview various mobile platforms that are broadly available today (iOS, Android, etc.). It will be followed by a detailed foray into broad array of topics in developing such applications and services, that include wireless communication issues, location-based services, cloud-based design, energy consumption and efficiency issues, human-computer interaction for small form factor devices, and system integration. A key focus of the course will be a semester-long programming project that will be done in groups of 4 or more. Students will be required to quickly come up to speed with their programming platform, define a specific project objectives in detail, and showcase a full application by the end of the semester.

Course syllabus and reading list

course material will be drawn mainly from research literature and maybe supplemented with readings from various text books. While it is natural to characterize topics according to layers of the protocol stack as discussed below, in many cases cross-layer design mechanisms are relevant. Such mechanisms will be discussed in an appropriate context. The following is a rough overview of the course lectures and related content (we may not stick to the exact schedule below and will modify content and their order based on various factors).

- Course overview and platform preliminaries (2 lectures)
- Programming platform in detail with labs: (17 lectures)
- Wireless communication --- variability of the wireless channel, intermittent connectivity, and design for unpredictable performance: (3 lectures)
- Mobile sensors and their functions --- how to accelerometer, gyroscope and other sensors work (2 lectures)
- Location based services --- GPS and non-GPS based localization techniques: (2 lectures)

- Energy efficiency --- energy consumption of different components, computation and communication tradeoffs: (2 lectures)
- Design for usability --- interface design issues for smartphones including touch-screen, gesture-based input, etc. (2 lectures)
- Miscellany --- mobile device security, privacy, cloud-based services, peer-to-peer applications, (2 lectures)

Programming assignments and projects

In the initial part of the semester (roughly until Spring break), the course will be structured in a series of lectures and labs. The labs will provide hands-on experience for the course. Students are expected to bring their personal laptops to the class for the labs as it will allow for maximizing the learning experience. There will also be multiple small programming assignments that will be required in the first 6 weeks. These programming assignments will help you to get a better hands-on experience about the different platforms and services available. However, the main focus of the course will be a semester long programming project which will be done in groups of four or more. More details on the programming project will be available soon. Please form your project groups early and please select your platform of choice quickly. For this main project, you can use any programming environment as long as it is a mobile environment: - iPhone SDK (programming in Swift or Objective C) - Android SDK (programming in Java) - Windows Mobile SDK (programming in Java) - HTML5/Jasvascript is also an option.

Class participation

This class is expected to be interactive. So participation in class discussions is important. You are encouraged to ask questions, present your viewpoint, disagree, and contribute to discussions in class.

In addition, we plan to use Piazza extensively for all forms of communication in the course. That is the reliable means to follow what is expected in form of assignments, projects, exams, and more. Your participation in Piazza is critical to the success. There are points assigned to class participation on your overall grade.

Grading criteria (subject to change)

 - Exams (mid-term 1 and 2): 30

- Programming assignments: 20

- Class participation: 5

- Project : 45

Total: 100

Textbook and reference material

There is no required text book for this class. However, there are many different forms of reference material. We will post them in piazza (which will be used extensively for the class).