CS 4518 Mobile and Ubiquitous Computing

Lecture 15: Final Project Slides/Paper, Other Ubicomp Android APIs

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The Rest of the Class

The Rest of this class

- **Part 1: Course and Android Introduction**
  - Introduce mobile computing, ubiquitous Computing, Android,
  - Basics of Android programming, UI, Android Lifecycle
- **Part 2: Mobile and ubicomp Android programming**
  - mobile Android components (location, Google Places, maps, geofencing)
  - Ubicomp Android components (camera, face detection, activity recognition, etc)
- **Part 3: Mobile Computing/Ubicomp Research**
  - Machine learning (classification) in ubicomp
  - Ubicomp research (smartphone sensing examples, human mood detection, etc) using machine learning
  - Mobile computing research (app usage studies, energy consumption, etc)

Final Project Submissions

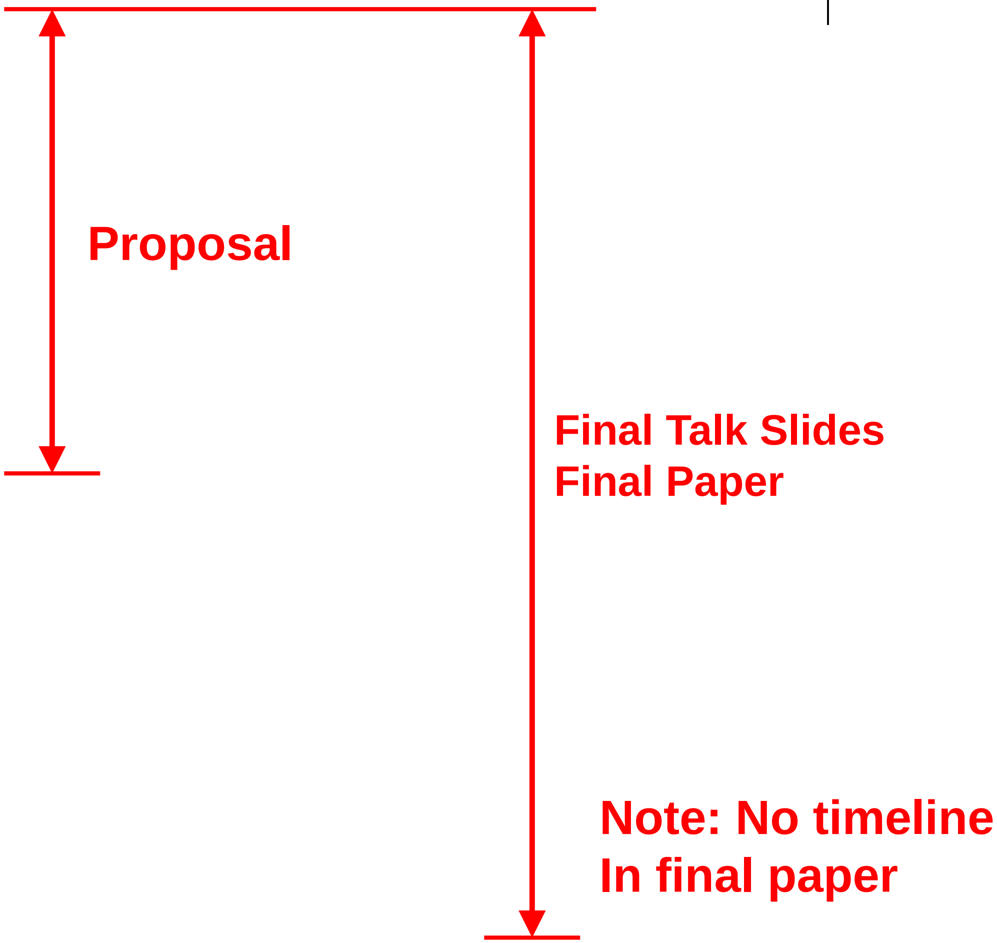
Final Project Submissions

- Still need to:
  - Give final **10-minute presentation** on your final app
  - Submit **final paper** describing your app
- Fully described on the final project website:
  - http://web.cs.wpi.edu/~emmanuel/courses/cs4518/C17/projects/final_project/
- Today: Just give a bit more detail, answer questions

Final Talk & Final Paper: Same Content

- Introduction
- Related Work
- Approach/methodology
- Implementation
- **Project timeline**

- Evaluation/Results
- Discussion
- Conclusion
- Future Work



Proposal

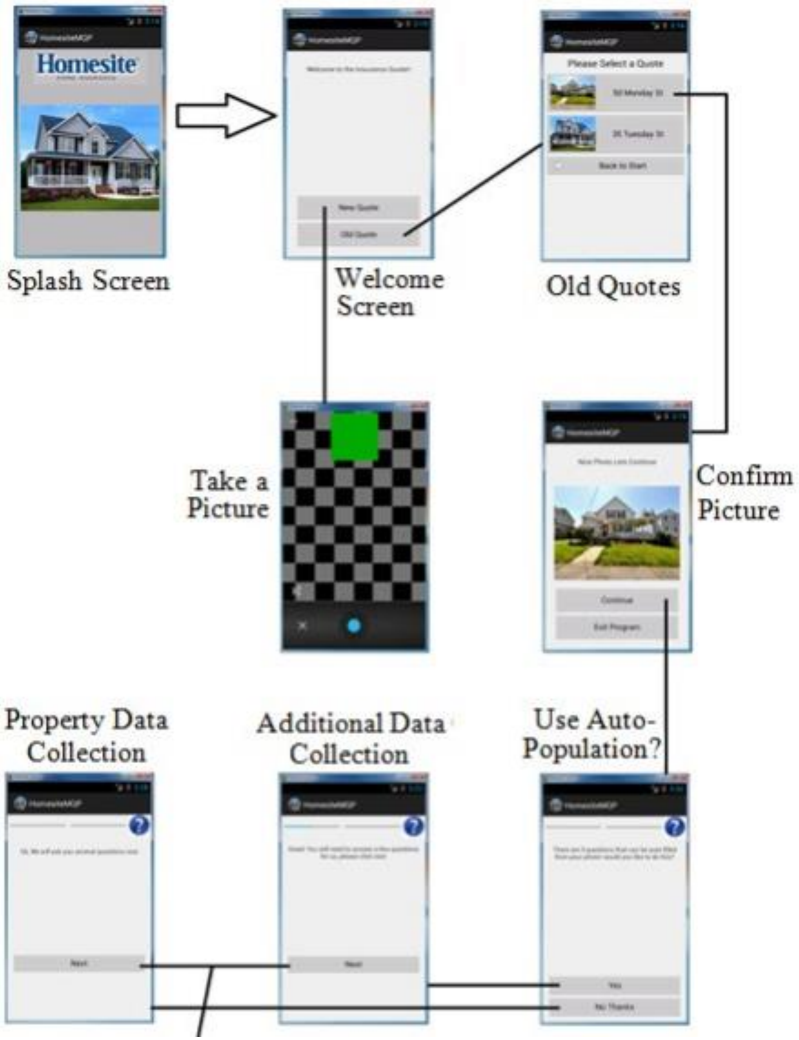
Final Talk Slides
Final Paper

Note: No timeline
In final paper

Final Talk & Final Paper

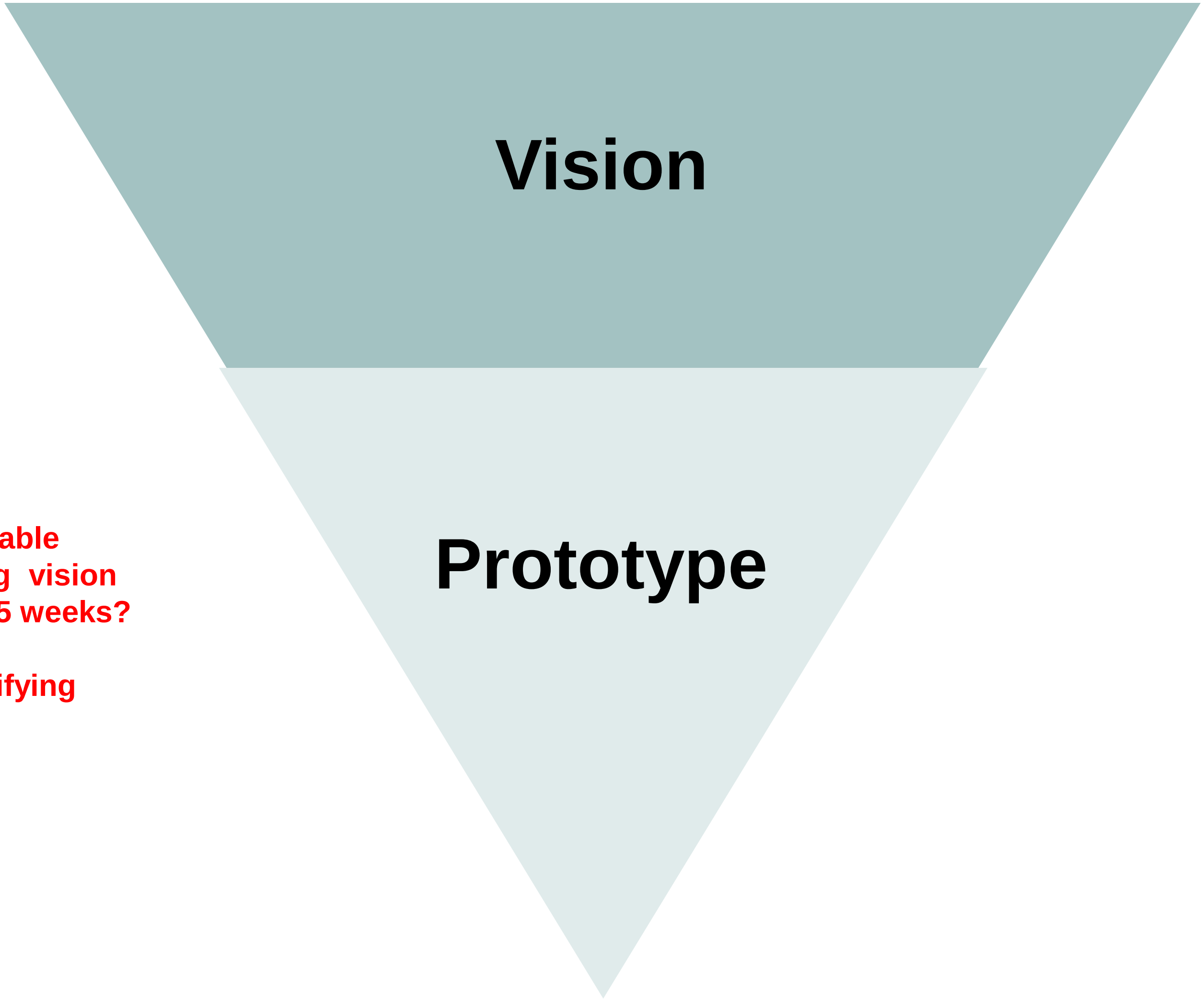
- **Final talk:** Mar 2 or 3 (7/8 groups each day)
- **Submit:** talk slides + final paper (Written 5 pages max Word + PDF file): due Mar 3, 11.59PM!!
- Details
  - **Introduction**
    - List team members
    - State problem app you solved + social benefit, target community
    - Why is problem important?
    - E.g. Find statistics: How much time, money, resources is being wasted on this problem today? How many people problem affects
    - Potential gain: how will your solution save time, money, etc?
  - **Related work**
    - What other research has been done to solve this problem (academic + commercial apps)
    - How is your app/approach different? And how is it similar?

Final Talk & Final Paper



- **Methodology/App Design:**
  - Summarize how your app works
  - Illustrate using final app screens/flow:

Separate Vision and Prototype



1. Big picture
if funds/time not
an issue
(e.g. company of
200 employees over
6 years)

2. Which reasonable
Subset of the big vision
can you do in 2.5 weeks?

Can make simplifying
assumptions

Final Talk & Final Paper

- Implementation details of your prototype:
  - E.g. Android, what modules? external tools? Packages? Etc
  - Emphasize mobile/ubicomp components used

Final Talk & Final Paper: Evaluation

- Depends on what your project is.
- **Basic question:** How well did your solution work?
  - **App user study:** post-survey after using your app
    - Get users to use/rate your app, ask users about likes dislikes
    - Will they use your app if available?
  - **Stretch?** Measure performance. E.g. energy consumption, bandwidth consumption, etc

Final Talk & Final Paper: Recruiting Subjects For User Studies

- 3Fs: Friends, Family and Fools
- Easy: Classmates (Do a trade with another group)
  - You guys evaluate our app, we'll evaluate yours
- On campus: post flyers, set up table at campus center
  - Probably overkill

Final Talk & Final Paper: Discussion, Conclusion, Future Work

- Discussion:
  - How was your app generally received? Rationalize your findings in user studies,
  - What aspects did users generally like/dislike?
  - Why you think certain features work? not work? etc

- Future work
  - Talk about features that would extend prototype in feature
  - Revisit big vision.

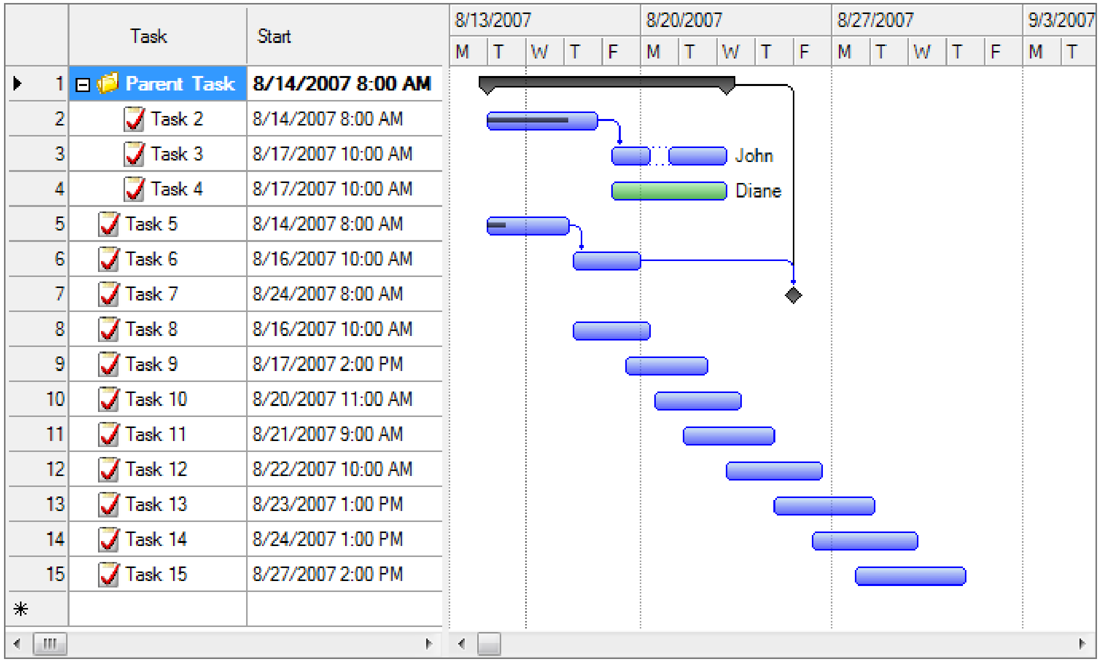
Your Team

Some Team Tips

- Everyone (team members) doesn't have to do everything equally
- Team members can work on project aspects they are good at
- Example: Who is good at:
  - Android UI design (Android Studio design view, XML file, widgets, nice look)
  - Android programming (database, sensors, maps, backend)
  - Experimental evaluation/user studies
  - Machine learning
  - Writing, making presentations

Some Team Tips

- Team should have an honest conversation
- Decide who is good at what aspects, do it!
- Consider team online management tools (trello.com, gantt charts, etc)
- Assign tasks, mini-deadlines (every few days)
- Integrate features every few days => new version
- **Mantra:** Always have a working prototype, improve



	Task	Start
1	⊟ Parent Task	**8/14/2007 8:00 AM**
2	Task 2	8/14/2007 8:00 AM
3	Task 3	8/17/2007 10:00 AM
4	Task 4	8/17/2007 10:00 AM
5	Task 5	8/14/2007 8:00 AM
6	Task 6	8/16/2007 10:00 AM
7	Task 7	8/24/2007 8:00 AM
8	Task 8	8/16/2007 10:00 AM
9	Task 9	8/17/2007 2:00 PM
10	Task 10	8/20/2007 11:00 AM
11	Task 11	8/21/2007 9:00 AM
12	Task 12	8/22/2007 10:00 AM
13	Task 13	8/23/2007 1:00 PM
14	Task 14	8/24/2007 1:00 PM
15	Task 15	8/27/2007 2:00 PM
*		

Project Resources

Resources

- I have set up a links page for mobile and ubicomp projects

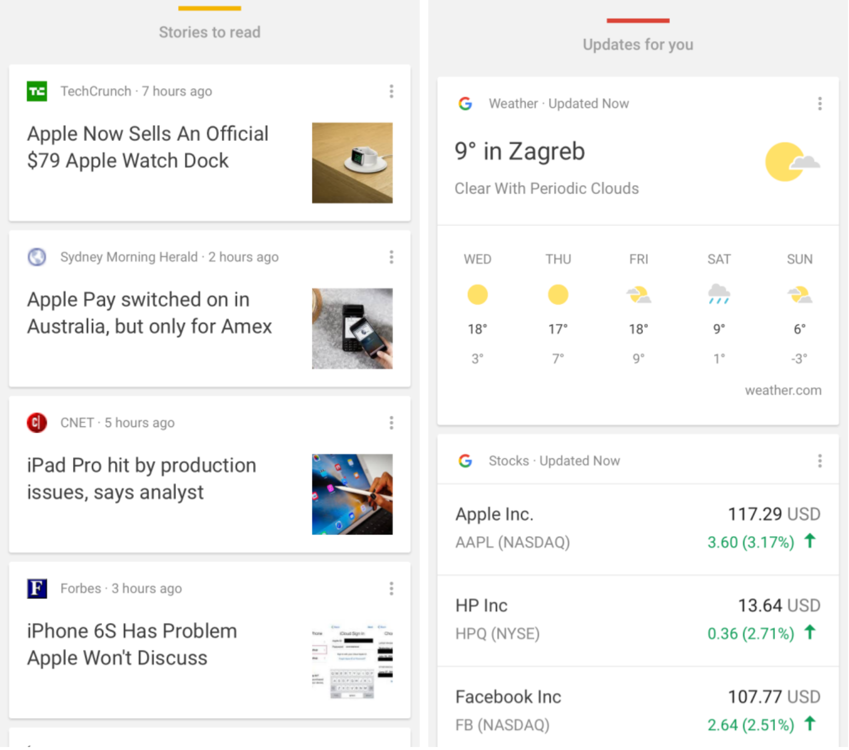
http://web.cs.wpi.edu/~emmanuel/courses/ubicomp_projects_links.html

What other Android APIs may be useful for ubicomp?

Google Now

- Intelligent assistant, gives
  - Recommendations (travel time, traffic, etc)
  - Information (e.g. scores from favorite spots teams)
- Works by recognizing repeated user actions on device (common locations, repeated calendar appointments, search queries, etc)
- Displays info as Information "Cards"

- **In future:** Can retrieve, use information on Google Now cards



Stories to read

TechCrunch · 7 hours ago

Apple Now Sells An Official $79 Apple Watch Dock

Sydney Morning Herald · 2 hours ago

Apple Pay switched on in Australia, but only for Amex

CNET · 5 hours ago

iPad Pro hit by production issues, says analyst

Forbes · 3 hours ago

iPhone 6S Has Problem Apple Won't Discuss

Updates for you

Weather · Updated Now

9° in Zagreb

Clear With Periodic Clouds

WED	THU	FRI	SAT	SUN
18°	17°	18°	9°	6°
3°	7°	9°	1°	-3°

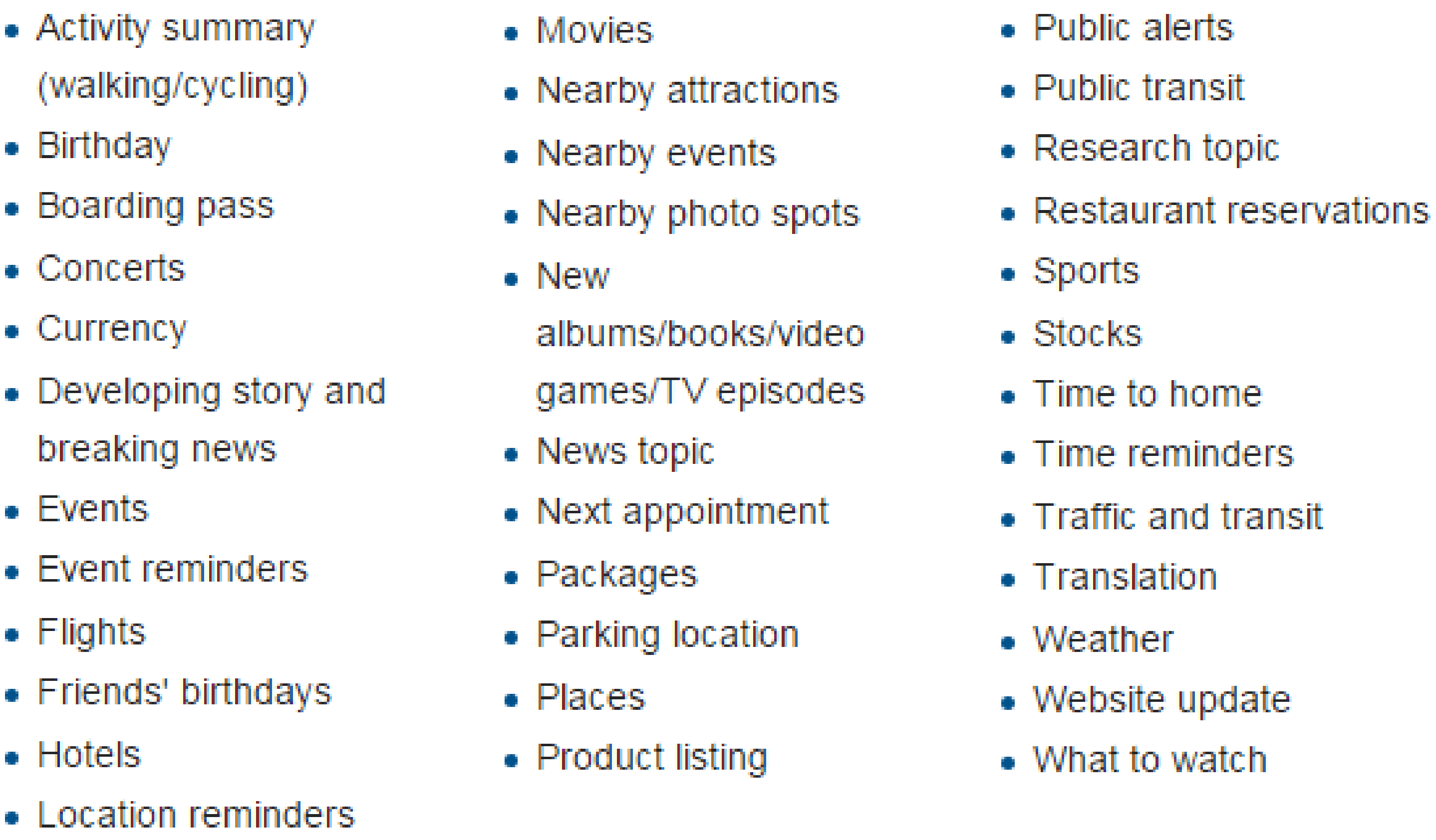
weather.com

Stocks · Updated Now

Apple Inc. AAPL (NASDAQ)	117.29 USD 3.60 (3.17%) ↑
HP Inc HPQ (NYSE)	13.64 USD 0.36 (2.71%) ↑
Facebook Inc FB (NASDAQ)	107.77 USD 2.64 (2.51%) ↑

Information on Google Now Cards

https://en.wikipedia.org/wiki/Google_Now

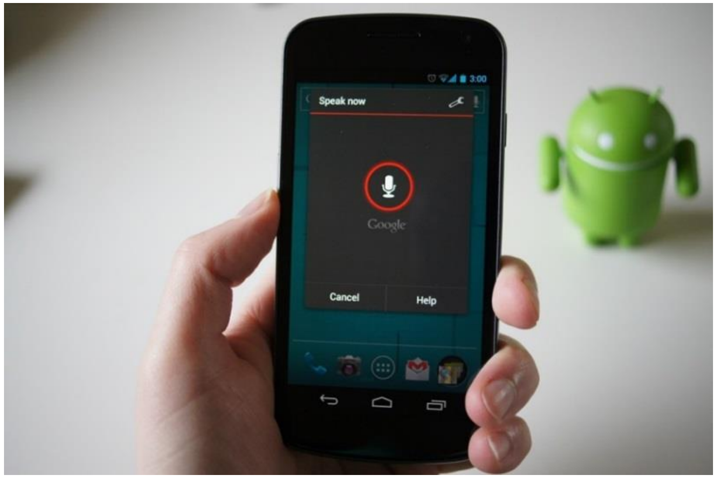


- Activity summary (walking/cycling)
- Birthday
- Boarding pass
- Concerts
- Currency
- Developing story and breaking news
- Events
- Event reminders
- Flights
- Friends' birthdays
- Hotels
- Location reminders
- Movies
- Nearby attractions
- Nearby events
- Nearby photo spots
- New albums/books/video games/TV episodes
- News topic
- Next appointment
- Packages
- Parking location
- Places
- Product listing
- Public alerts
- Public transit
- Research topic
- Restaurant reservations
- Sports
- Stocks
- Time to home
- Time reminders
- Traffic and transit
- Translation
- Weather
- Website update
- What to watch

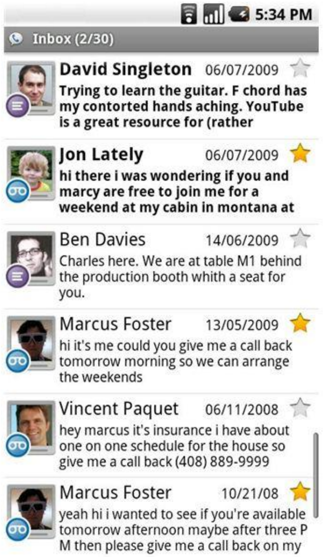
Speaking to Android

http://developer.android.com/reference/android/speech/SpeechRecognizer.html
https://developers.google.com/voice-actions/

- **Speech recognition:**
  - Accept inputs as speech (instead of typing) e.g. dragon dictate app?
  - Note: Requires internet access
- **Speech-to-text**
  - Convert user's speech to text. E.g. display voicemails in text
- **Voice Actions:** Voice commands to smartphone (e.g. search for, order pizza)



Speech to text



5:34 PM

Inbox (2/30)

David Singleton 06/07/2009 ☆
Trying to learn the guitar. F chord has my contorted hands aching. YouTube is a great resource for (rather

Jon Lately 06/07/2009 ★
hi there i was wondering if you and marcy are free to join me for a weekend at my cabin in montana at

Ben Davies 14/06/2009 ☆
Charles here. We are at table M1 behind the production booth whith a seat for you.

Marcus Foster 13/05/2009 ★
hi it's me could you give me a call back tomorrow morning so we can arrange the weekends

Vincent Paquet 06/11/2008 ☆
hey marcus it's insurance i have about one on one schedule for the house so give me a call back (408) 889-9999

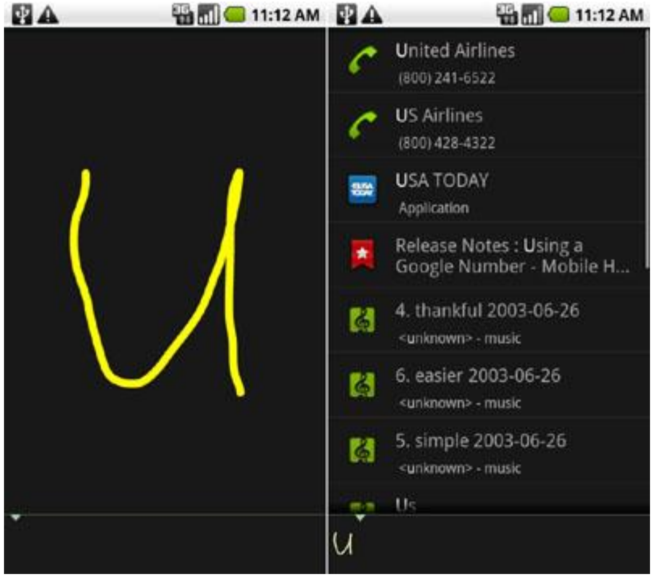
Marcus Foster 10/21/08 ★
yeah hi i wanted to see if you're available tomorrow afternoon maybe after three P M then please give me a call back on my

Gestures

https://developer.android.com/training/gestures/index.html

http://www.computerworld.com/article/2469024/web-apps/android-gestures--3-cool-ways-to-control-your-phone.html

- **Gesture:** Hand-drawn shape on the screen
- Example uses:
  - Search your phone, contacts, etc by handwriting onto screen
  - Speed dial by handwriting first letters of contact's name
  - Multi-touch, pinching



11:12 AM

11:12 AM

United Airlines
(800) 241-6522

US Airlines
(800) 428-4322

USA TODAY
Application

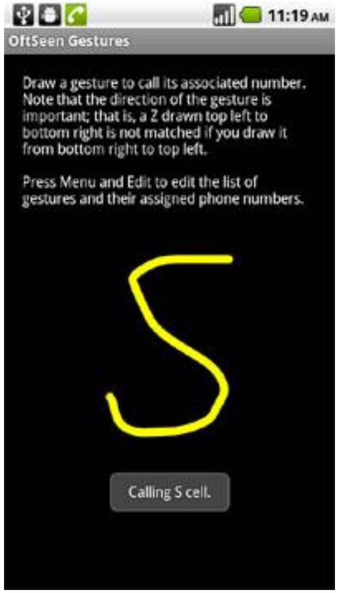
Release Notes : Using a Google Number - Mobile H...

4. thankful 2003-06-26
<unknown> - music

6. easier 2003-06-26
<unknown> - music

5. simple 2003-06-26
<unknown> - music

Us



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OftSeen Gestures

Draw a gesture to call its associated number. Note that the direction of the gesture is important; that is, a Z drawn top left to bottom right is not matched if you draw it from bottom right to top left.

Press Menu and Edit to edit the list of gestures and their assigned phone numbers.

More MediaPlayer & RenderScript

http://developer.android.com/guide/topics/renderscript/compute.html

- Media Player can also **record** audio and video
  - Manipulate raw audio from microphone/audio hardware, PCM buffers
    - E.g. if you want to do audio signal processing, speaker recognition, etc
    - **Example:** process user's speech, detect emotion, nervousness?

- **RenderScript**
  - High level language for GPGPU
  - Use Phone's GPU for computational tasks
  - Very few lines of code = run GPU code
  - Useful for heavy duty tasks. E.g. image, video processing

Wireless Communication

http://developer.android.com/guide/topics/connectivity/bluetooth.html
http://developer.android.com/reference/android/net/wifi/package-summary.html

- Bluetooth
  - Discover nearby bluetooth devices
  - Communicating over bluetooth

- WiFi
  - Scan for WiFi hotspots
  - Monitor WiFi connectivity, Signal Strength (RSSI)
  - Do peer-to-peer (mobile device to mobile device) data transfers

Wireless Communication

http://developer.android.com/guide/topics/connectivity/nfc/index.html

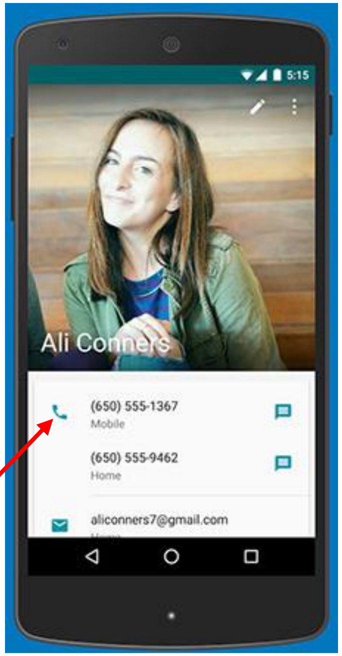
- NFC:
  - Contactless technology
  - Transfer small amounts of data over short distances
  - **Applications:** Share spotify playlists, Google wallet
  - **Google wallet?**
    - Store debit, credit card on phone
    - Pay by tapping terminal

Telephony and SMS

http://developer.android.com/reference/android/telephony/package-summary.html
http://developer.android.com/reference/android/telephony/SmsManager.html

- **Telephony:**
  - Initiate phone calls from within app
  - Access dialer, etc

- **SMS:**
  - Send/Receive SMS/MMS from app
  - Handle incoming SMS/MMS in app



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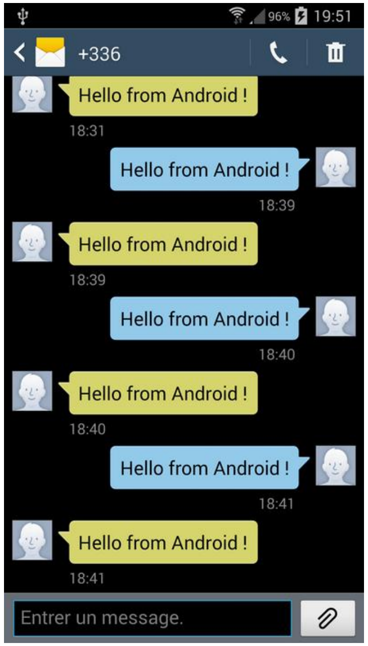
Ali Conners

(650) 555-1367
Mobile

(650) 555-9462
Home

aliconners7@gmail.com

Dialer



96% 19:51

+336

Hello from Android !
18:31

Hello from Android !
18:39

Hello from Android !
18:39

Hello from Android !
18:40

Hello from Android !
18:40

Hello from Android !
18:41

Hello from Android !
18:41

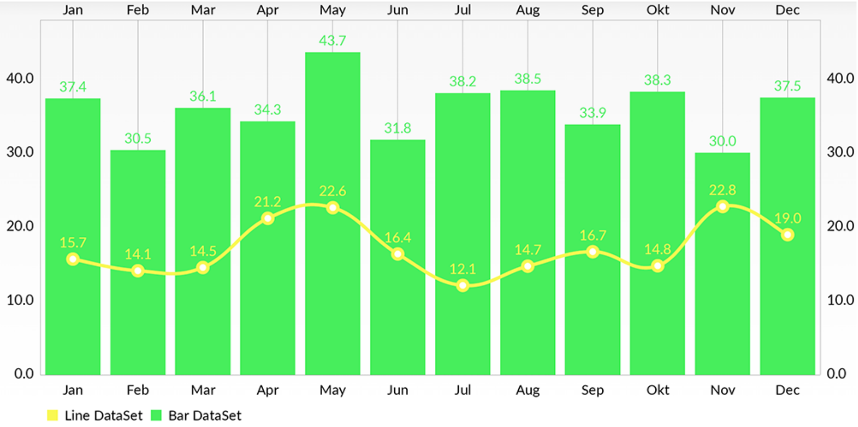
Entrer un message.

SMS

Other 3rd Party Stuff

http://web.cs.wpi.edu/~emmanuel/courses/ubicomp_projects_links.html

- **MPAndroid:** Add charts to your app



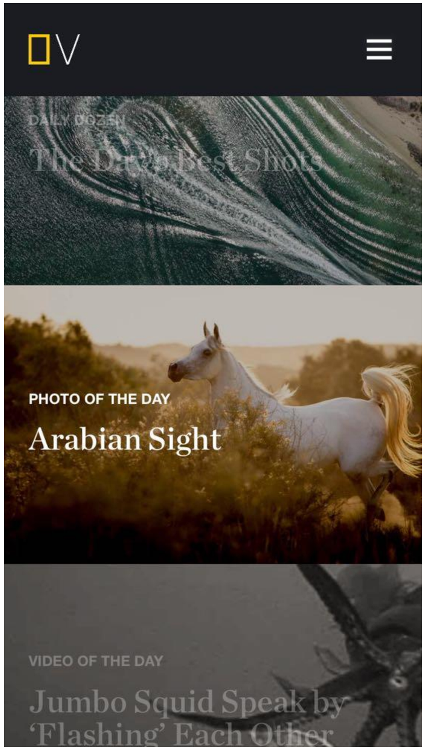
- **Trepn:** Profile energy usage of your app

Other 3rd Party Stuff

http://web.cs.wpi.edu/~emmanuel/courses/ubicomp_projects_links.html

- **Programmable Web APIs:** 3rd party web content (e.g RESTful APIs) you can pull into your app with few lines of code
  - **Weather:** Weather channel, yahoo weather
  - **Shared interests:** Pinterest
  - **Events:** Evently, Eventful, Events.com
  - **Photos:** flickr, Tumblr
  - **Videos:** Youtube
  - **Traffic info:** Mapquest traffic, Yahoo traffic

- **E.g. National Geographic:** picture of the day



DAILY DOZEN

The Day's Best Shots

PHOTO OF THE DAY

Arabian Sight

VIDEO OF THE DAY

Jumbo Squid Speak by 'Flashing' Each Other