Location Based Services

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References

- Location Strategies, Android Developer Web site, http://developer.android.com/guide/topics/location/strategies.html
- Location and Sensors APIs, http://developer.android.com/guide/topics/sensors/index.html
- Location and Maps, http://developer.android.com/guide/topics/location/index.html
- Ch. 14. Using Location-Based Services (LBS) APIs, from the book ***Android Wireless Application Development***, 2nd Edition, by Laurent Darcey and Shane Condo, published by Addison Wesley, pp. 317-333.
- Ch. 12. Location-Based Services, from the book The Android Developer's Cookbook, 2nd Edition, by Ronan Schwarz, Phil Duston, James Steel, and Nelson To, published by Addison Wesley, pp. 315-341
- Location-Based Services, by Kathryb Zickuhr, PewResearch Internet Project, Sept. 12, 2013, http://www.pewinternet.org/2013/09/12/location-based-services/
- Best Practices and Guidelines for Location Based Services, http://www.ctia.org/policy-initiatives/voluntary-guidelines/best-practices-and-guidelines-for-location-based-services
- iParking: An Intelligent Indoor Location-Based Parking Services, by J. Liu, R. Chen, Y. Chen, L. Pei, and L. Chen, Sensors 2012, http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3522932/

1. Location-Based Services (LBS)

- Definition:
  - A general class of computer program-level services that use location to control features. http://en.wikipedia.org/wiki/Location-based_service
  - An information service that use information on the geographical position of the mobile device
  - LBS are used in a variety of context, such as health, Indoor object search, entertainment, work, personal life.
- Application Examples
  - Most popular mobile apps use and integrate location with many functions, such as
    - Internet searching
    - Picture taking
    - Gaming
    - Social networking
- LBS Apps
  - Mobile Commerce
  - GPS-based app
  - ATM locator
  - Mapping apps
  - packing locator, parking spot tracker
  - GPS navigation
  - Parcel tracking
  - Vehicle tracking
  - Proximity alerts
  - Geocoding translations
- Companies that offer LBS products

    - TCS, http://www.telecomsys.com/products/default.aspx
        - Enabling Convergent Technologies
        - Mobile Communication Technologies
        - Products
            - Connected health
            - Emergency alerts
            - Messaging
            - Navigation and Telematics
            - Public Safety Solution (Wireless E9-1-1, E1-1-2)
            - Work force tracking
            - Parking services
    - Pango Mbile Parking, http://www.parking-net.com/parking-industry/pango-mobile-parking
        - On-street parking and open service lots
        - Gated off-street garages
        - Valet service system
        - Location-based advertising and promotions
- Location-Based Services Products, Broadcom, http://www.broadcom.com/products/GPS/Location-Based-Services
    - Worldwide Reference Network (WWRN), AGSP Server, GLONASS, Long Term Orbits (LTO), SUPL Location Platform (SLP)
- Location Based Services Startups, https://angel.co/location-based-services
- Mobile Startups, https://angel.co/mobile-2

2. **Location (geography)**, http://en.wikipedia.org/wiki/Location_(geography)
    - The terms location and place in geography are used to identify a point or an area on the Earth's surface or elsewhere.
    - Latitude, Longitude

3. **Worldatlas**, http://www.worldatlas.com/aatlas/imageg.htm
    - Latitude – the angular distance in degree, minutes, and seconds of a point north or south of the Equator. Lines of latitude are often referred to as parallels.
4. **Best Practices and Guidelines for Location Based Services**, http://www.ctia.org/policy-initiatives/voluntary-guidelines/best-practices-and-guidelines-for-location-based-services

5. Satellite Communications

- GOES (Geostationary Satellite) Systems
    - 36,000 km above the equator
    - Transponder data rate – 50 Mbps, at 4/6. 11/14, and 20/30 GHz bands
- LEOS (Low-Earth Orbit Satellite) Systems
- MEOS (Multiple-mission Earth Observatory Satellite) Systems
- GPS (satellite), http://en.wikipedia.org/wiki/GPS_(satellite)
    - Navistar 1, 1st GPS system, launched Feb. 22, 1978

GOES Satellite

- Significant satellite operators & Industries http://www.3g-generation.com/satellite.htm

- GOES Satellites http://ww2010.atmos.uiuc.edu/(Gh)/guides/rs/sat/goes/home.rxml
- GOES Science Projects http://rsd.gsfc.nasa.gov/goes/
- GOES Servers
    - http://www.goes.noaa.gov/
    - http://www.goes.noaa.gov/g8hu.html

LEO Satellite

- Overview of LEO Satellite Systems http://www.its.bldrdoc.gov/meetings/art/art99/slides99/red/red_s.pdf
- LEOS (Low-Earth Orbit Satellite)
    - Technologies and Trends - http://www.mindbranch.com/listing/product/R201-084.html
- Routing and Multicasting in LEO Satellite IP Networks, http://users.ece.gatech.edu/~cchen/routing/drp.html

MEOS Satellite

- Multiple-mission Earth Observatory Satellite, http://www.eumetsat.de/en/area2/proceedings/eump33/pdf/session_5/software/oynes.pdf

Power Radiation Pattern

- Isotropic (unidirectional) – equal transmission energy in all direction
- Anisotropic (directional) – different in one or more directions

The GPS satellites, http://en.wikipedia.org/wiki/GPS_(satellite)

- Navistar 1, 1st GPS system, launched Feb. 22, 1978
- Circle the Earth at an altitude of about 20,000 km and complete two full orbit every day.
- Block I satellites (10), Navistar 1, launched 10 Block I GPSs, Navistar 7 was lost
- Block II satellites (28), launched on 1989 – 1990; the final satellite was decommissioned on March 15, 2007, well past its 7.5 year design life
- Block IIA (19), 1990 – 1997; As of Jan. 17, 2009, 6 satellite have been removed from service
- Block IIR (12), 1997 -?
- **Block IIR-M**, include a new military signal and a robust civil signal, known as L2C; launched period 2005-2009
- **Block IIF,** launched 2011, a design life of 12 years.
- **Block IIIA,** awarded contract to Lockheed Martin in 2008, up to 32 satellites with a design life of 15 years

GPS Magazines

- GPS world
- GPS magazine

6. **Location Strategies**, Android Developer Web site, http://developer.android.com/guide/topics/location/strategies.html

7. **Android-based LBS Packages, Classes**

package android.location, https://developer.android.com/reference/android/location/package-summary.html

- Contains the framework API classes that define Android location-based and related service
- Interfaces

    - GpsStatus.Listener
    - GpgStatus.NmeaListener
    - LocationListener
- Classes
    - Location, https://developer.android.com/reference/android/location/Location.html
        - A data class representing a geographic location
        - A location can consists of a latitude, longitude, timestamp, and other information such as bearing, altitude and velocity
    - LocationManager, https://developer.android.com/reference/android/location/LocationManager.html
        - This class provides access to the system location services.
        - Allow applications to obtain periodic updates of device's geographic location, or to fire an application-specified Intent when the device enters the proximity of a given geographical location.
    - LocationProvider, https://developer.android.com/reference/android/location/LocationProvider.html
        - An abstract superclass for location providers.
        - A location provider provides periodic reports on the geographic location of the device
    - Address, https://developer.android.com/reference/android/location/Address.html
        - A class representing an Address, i.e. a set of Strings describing a location. The address format is a simplified version of xAL.
        - OASIX xAL (eXtensible Address Language) Standard V2.0, http://www.oasis-open.org/committees/ciq/ciq.html#6
    - Criteria, https://developer.android.com/reference/android/location/Criteria.html
        - A class indicating the application criteria for selecting a location provider.
        - Providers may be ordered according to accuracy, power usage, ability to report altitude, speed, and bearing, and monetary cost.
    - Geocoder, https://developer.android.com/reference/android/location/Criteria.html .
        - A class for handling geocoding and reverse geocoding
        - Geocoding is the process of transforming a street address or other description of a location into a (latitude, longitude) coordinate into a (partial) address.
    - GpsSatellite, https://developer.android.com/reference/android/location/GpsSatellite.html
        - Represents the current state of a GPS satellite
            - float getAzimuth() – returns the azimuth of satellite in degrees between 0 and 360
            - float getElevation() – returns the elevation of the satellite in degrees between 0 to 90
            - getPrn() – returns the PRN (pseudo-random number) for the satellite
            - getSnR() – return the signal to noise ratio for the satellite
            - hadAlmanac() – returns true if the GPS engine has almanac data for the satellite
            - hasEphemeris() – returns true if the GPS engine has ephemeris data for the satellite
            - usedInFix() – return true if the satellite was used by the GPS engine when calculating the most recent GPS fix
    - GpsStatus, https://developer.android.com/reference/android/location/GpsStatus.html

        - This class represents the current state of the GPS engine
        - getMaxSatellites()
        - getSatellite()
        - getTimeToFirstFix()
    - SettingInjectorService, https://developer.android.com/reference/android/location/SettingInjectorService.html
        - Dynamically specifies the enabled status of preference injected into the list of app settings displayed by the system setting app.

Google Location Services API

- Part of Google Play services, is the preferred way to add location-awareness to your app. It offers a simpler API, higher accuracy, high-power geofencing, and more
- Interfaces
    - public static interface GpsStatus.Listener, https://developer.android.com/reference/android/location/GpsStatus.Listener.html
        - Used for receiving notifications when GPS status has changed
    - GpSStatus.NMealListner – Used for receiving NMEA sentences from the GPS
    - LocationListner – Used for receiving notifications from the LocationManager when the location has changed
    -

Google Maps, https://www.google.com/maps/@41.158307,-85.0498925,13z

- Latitude and longitude coordinates, https://support.google.com/maps/answer/18539?hl=en
    - Degrees, minutes and second (DMS)
    - Degrees and decimal minutes (DMM)
    - Decimal degrees (DDD)

Android Location Based Service Examples

- Making Your App Location Aware, https://developer.android.com/training/location/index.html
    - Retrieving the Current Location, http://developer.android.com/training/location/retrieve-current.html
    - Receiving Location Updates
    - Displaying a Location Address
    - Creating and Monitoring Geofences
    - Recognizing the User's Current Activity
    - Testing Using Mock Locations