User Interaction: Intro to Location

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Global Location GPS
Global Location GPS

- Current GPS
  - Fully operational
  - accurate, continuous, global 3-D position and velocity
  - also distributes universal coordinated time
- 24 original satellites
- 6 orbital places
- 4 satellites per plane
- not geosynchronous
- world-wide monitoring stations
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• Current GPS

• Based on

  • Time Of Arrival (TOA) of radio signal
  • knowledge of satellite orbits

• Satellites have atomic clocks on board

• 2 frequencies

  • L1 1575.42 MHz
  • L2 1227.6 MHz
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• Current GPS

• Broadcasts
  • Time of transmission
  • Ephemeris: Precise satellite orbital info
  • Almanac: System health info, rough orbital info for all satellites
Intro to Location

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- Current GPS
- Receiver requirements
  - Must have local clock
  - 3-D position requires four satellites
    - four unknowns (what are they?)
    - time or height reduces this
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- Basic concept is based on the foghorn paradigm
- but in 3-D
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Intro to Location

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1 sec

Flickr: mafleen, greenstorm, templarion
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1 sec

1.5 sec

2 sec

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- Basic concept is based on the foghorn paradigm
- but in 3-D
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- What are the implications of this design on
  - scalability of the system?
  - privacy of users?
  - security of users?
  - reliability?
  - implications on device?
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- GPS accuracy
  - 13 m 95% of the time horizontal
  - 22 m 95% of the time vertical system
  - 40 ns 95% of the time
- How do you design for this?
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• GPS accuracy
  • 13 m 95% of the time horizontal
  • 22 m 95% of the time vertical system
  • 40 ns 95% of the time

• How do you design for this?

• Urban canyons
  • What are they?

• Japanese response, European response
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Latitude  Longitude

Frequency Count

Wednesday, October 19, 11
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- The current and future of GPS
  - WAAS
    - Additional satellites in geosynchronous orbit
  - DGPS assistance from a land based receiver
  - Galileo
    - European competitor
    - GPS compatible
  - GLONASS
    - Russian competitor
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• The current and future of GPS

• BeiDou
  • Chinese competitor
  • centralized system
Bei-dou

Time of arrival

Eureka!
(lat, long)

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Bei-dou

Eureka!
(lat, long)

Position

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Bei-dou Position

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• What are the implications of this design on
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  • security of users?
  • reliability?
  • implications on device?
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http://en.wikipedia.org/wiki/File:Qzss-45-0.09.jpg
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- The current and future of GPS
- Japanese Quasi-Zenith System
Global Location GPS

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Localization beyond satellite systems
Two things seem particularly interesting about Google’s approach. First, it relies on very detailed maps of the roads and terrain, something that Urmson said is essential to determine accurately where the car is. Using GPS-based techniques alone, he said, the location could be off by several meters.