New Dimensions of Mobile Data Quality

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Overview of Sensors in Mobile Technology

Consider this….

- Relative computing power of modern mobile devices:
    – Average smartphone is 100 times more powerful than the average satellite (NASA, 2012).
    – The first computer could perform 385 multiplications per second while modern iPhones can perform 2,000,000,000 instructions per second (Straus, 2012).
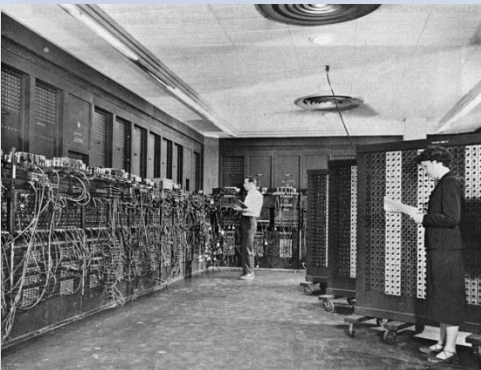

Image source: http://www.bitrebels.com/technology/power-in-your-palm-the-computing-power-in-todays-smartphones/attachment/eniac-the-worlds-first-computer-2/
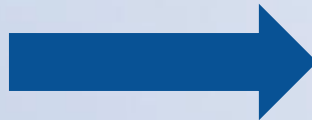

Image source: http://www3.pcmag.com/media/images/406235-google-nexus-5-unlocked.jpg?thumb=y

Sensors and New Data Quality Possibilities

- Accelerometer
  - Linear Acceleration
  - Rotation vector
  - Gyroscope
- Ambient temperature
- Audio
- Camera (front and back)

- Air pressure
- Proximity
- Light
- Global Positioning System
- Magnetic Field
- Gravity

- Questions to consider…
  - How can we use sensors to improve data quality?
  - Can we finally rid survey research of "curb stoning?"
  - How do we recommend organizations approach data quality with mobile technology?

Towards a Mobile Data Quality Framework
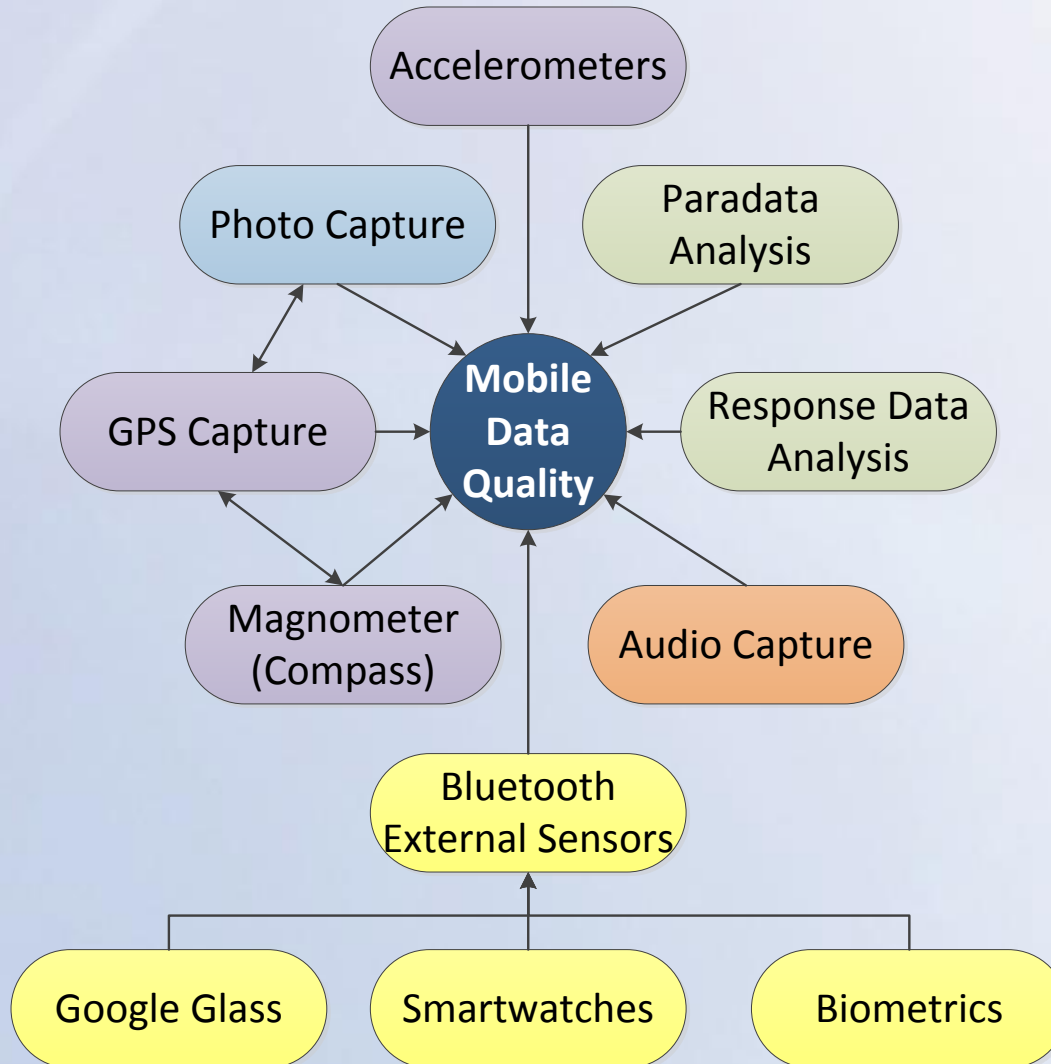
Lessons Learned from In-Person Field Survey Implementations

Computer Audio-Recorded Interview

- CARI was initially developed for use on laptops.
  - Audio quality was not always great.

- Audio quality in mobile technology is much improved.
  - Isolation of respondent voices to limit background noise.
  - Enough sensitivity to detect relatively quiet voices and the voice of someone on the other side of the room.

- Collecting CARI files is easier than ever, audio files are small (usually only a few kilobites), and data connection speeds are fast enough to allow for fast upload.

Global Positioning Systems (GPS)

- Common in modern mobile devices.

- Flexible implementations for researchers:
  - Active GIS coordinate capture by interviewer.
  - Passive GIS coordinate capture during survey administration.

- Data quality implications:
  - Detect accidental error.
  - Create automated ways to flag cases for possible falsification.

Geofencing Address-Based Samples

- Create virtual perimeters to proactively detect survey error.

Looks good!

Accidental error?

How accurate is the GPS?

- Collected coordinates at ~18,000 households in a recent field study.

- 95% of coordinates were accurate within 26 feet.

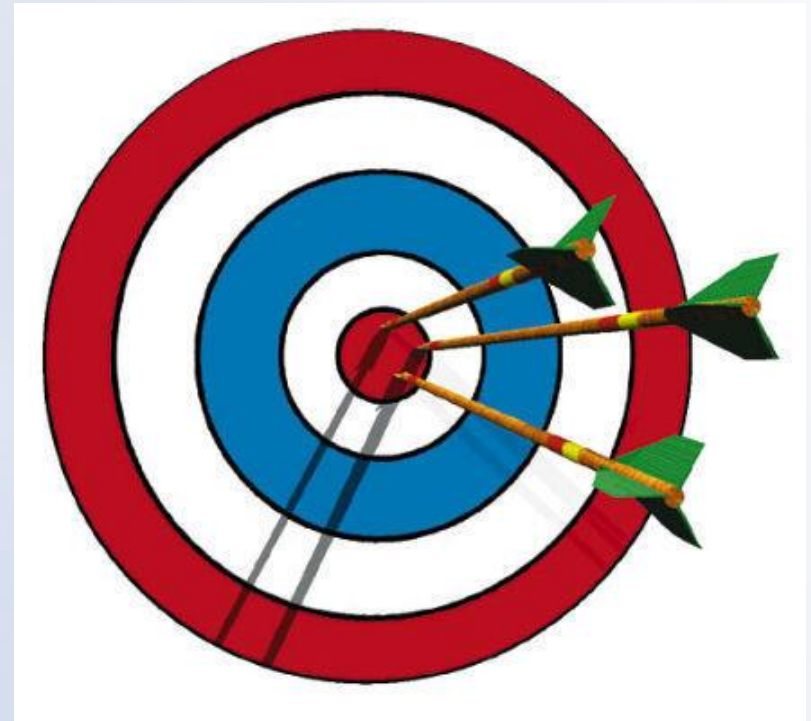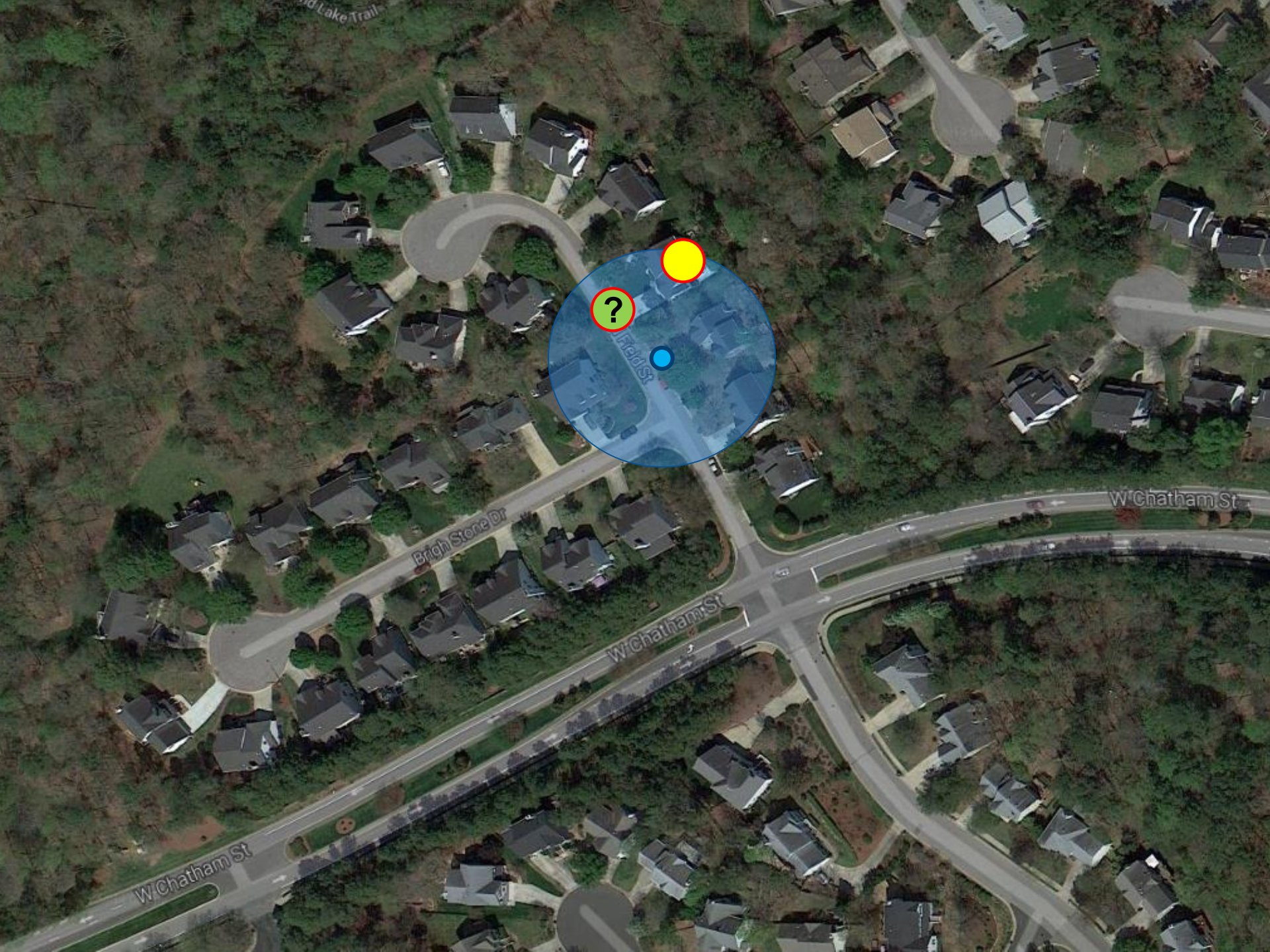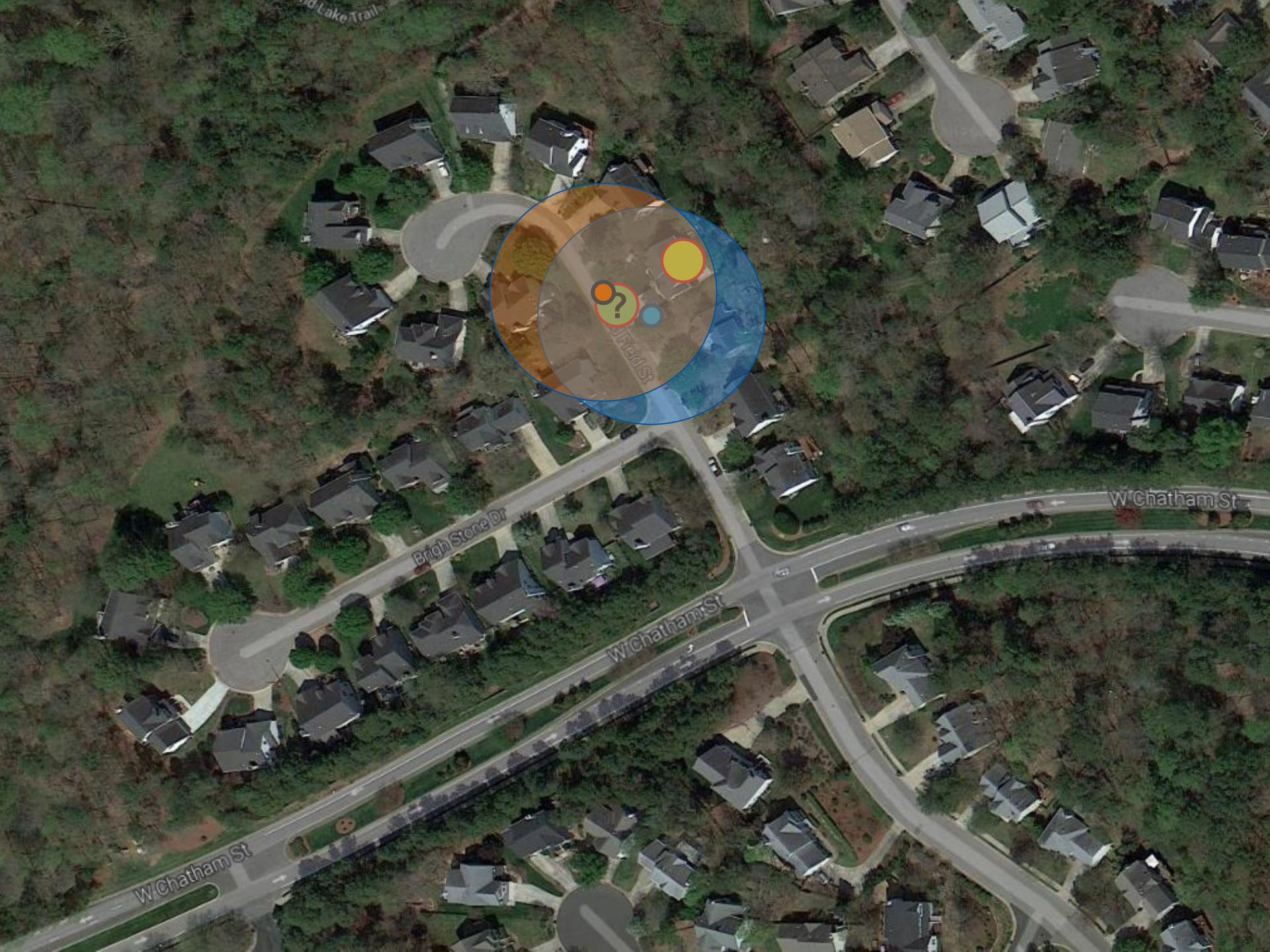- 99% of coordinates were accurate within 80 feet.

Image source: http://www.trbimg.com/img-51561838/turbine/sfl-hurricane-center-breaks-accuracy-records-2-002/440/440x400

Geotagged Photography

Combine Photography with GPS

- Photo quality is sufficient, even at twilight.

- Combine photography with geographic coordinates to verify FI location.

- Supplement with additional data sources for additional verification.

Too much data!

Image Source: http://cloudtweaks.com/wp-content/uploads/2012/10/cloud-hoskins.jpg

Tips for Future Implementers

- It's so easy to collect these data that it should always be done on outgoing CAPI surveys.

- One GPS coordinate is not enough.

- Remove the human and automate whenever possible!

- Create a single data quality hub that allows managers to consume mobile data quality points in a single location.

- Use a sampling framework to verify a subset of cases and adjust accordingly.

Expanding Future Possibilities
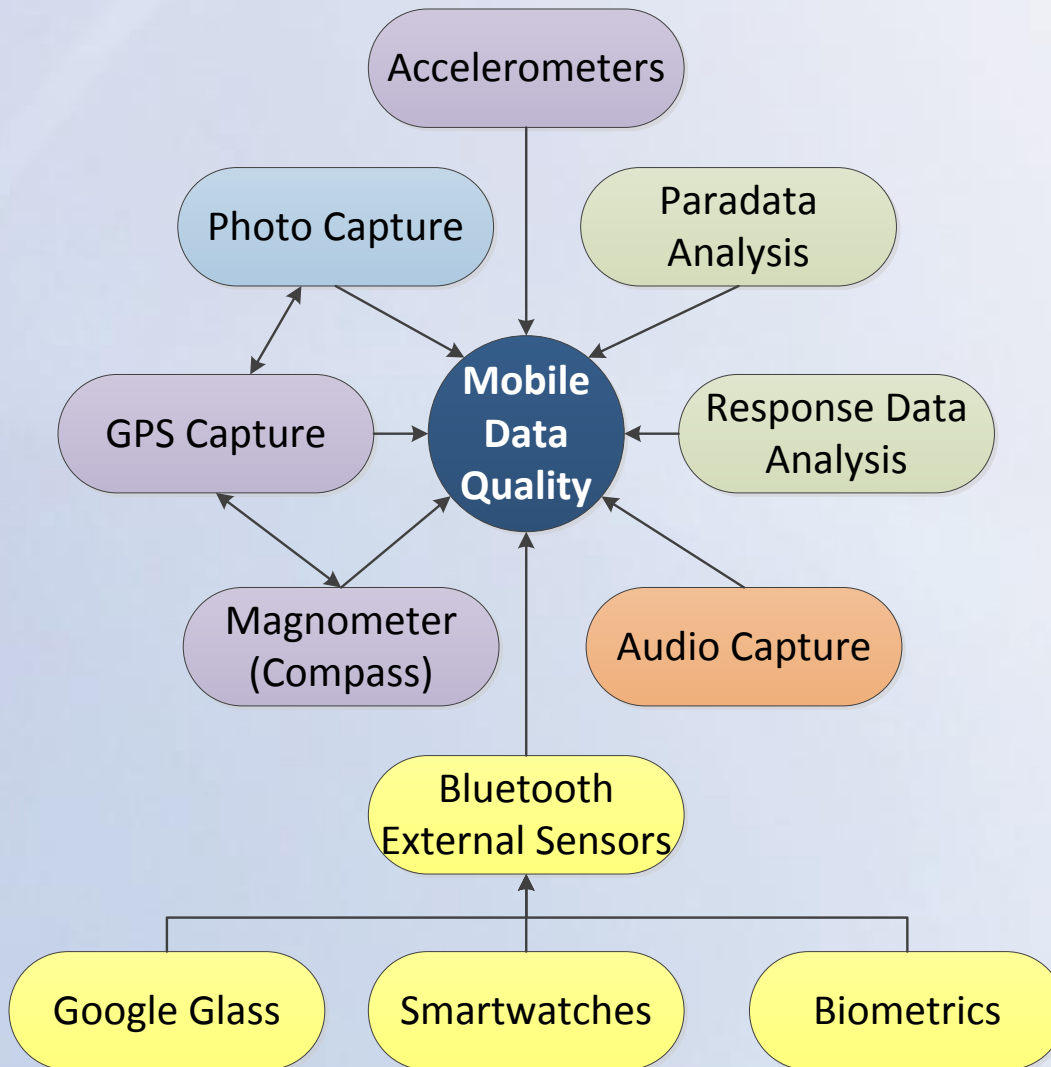
The Internet of Things has Arrived

- Google Glass
  - Does augmented reality and navigation improve survey data quality?

- Complex Accelerometers
  - We would expect certain patterns of field interviewer physical activity before and after an interview. Can we use this to catch curb stoning?

- Biometrics
  - Could we use biometric sensors on interviewers to catch falsification?

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Conclusions

- Mobile data collection has unlocked a whole spectrum of new data quality possibilities.

- To date we have not found a "silver bullet" that solves all data quality issues and catches all falsification.

- Combine multiple data quality points to create a multidimensional approach to field studies.

- Collecting these data quality points on field studies should be considered survey best practice.

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