# Ubiquitous and Mobile Computing

## CS 403x: *Tapping into the Vibe of the City Using VibN*

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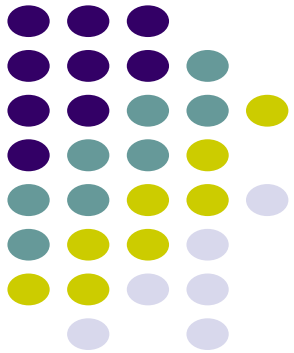
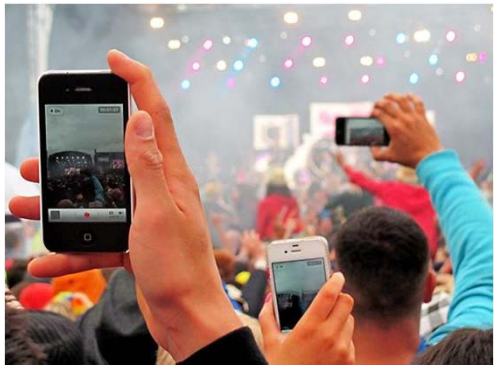
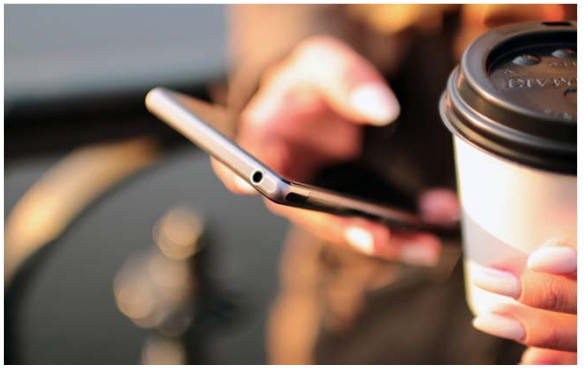


# Using What is Available

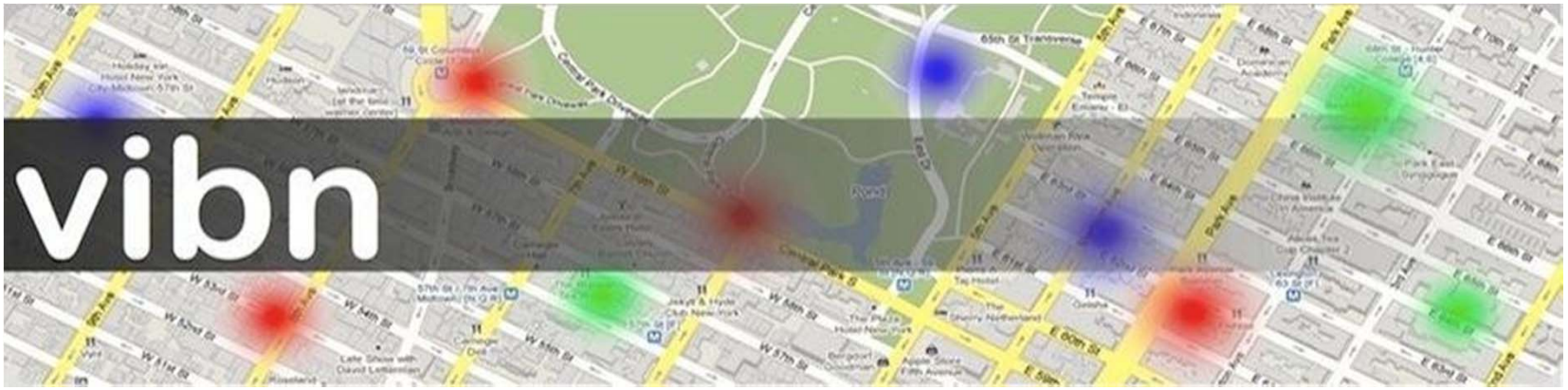
- Most people possess smartphones
  - People carry their phones everywhere
- Modern smartphones contain various sensors
- App utilizes this knowledge





# Introduction/Motivation

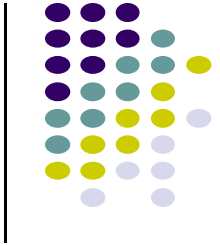
- VibN - continuous sensing applications
  - Platform to collect information-rich data
    - Characterization of human activity and context



# Introduction/Motivation

- Goal
  - Collect data
  - Make inferences
  - Present as visual data about Live Points of Interest (LPOI)
  - Engage the user in events around their area

# Related Work



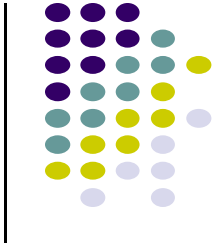
- CenceMe - application infers a person's daily activities and context through sensor use, allows characterization of locations based on sensor data

- Foursquare - application recommends areas to visit based off of location and user reviews

# Sensor Data Conveys Strong Keys

- Strong Data
  - Location Data
  - Short Audio Clips
- Difficulty
  - Accelerometer Implementation
  - Resource Consumption

# Location's Meaning Derived by App



- Duty Cycling Manager
- User Bio Statistics
- Reconcile Data with Criteria
  - Interval Pinging
  - Change in position
  - Length of Stay

# Summation of Individual Datum

- Numerous Requests from Individual
- Crowd-sourced information
- Individual Points of Interest
- Prevention of false positives
  - K = 5 test
  - Epsilon = 0.2
- POI Bounding Box

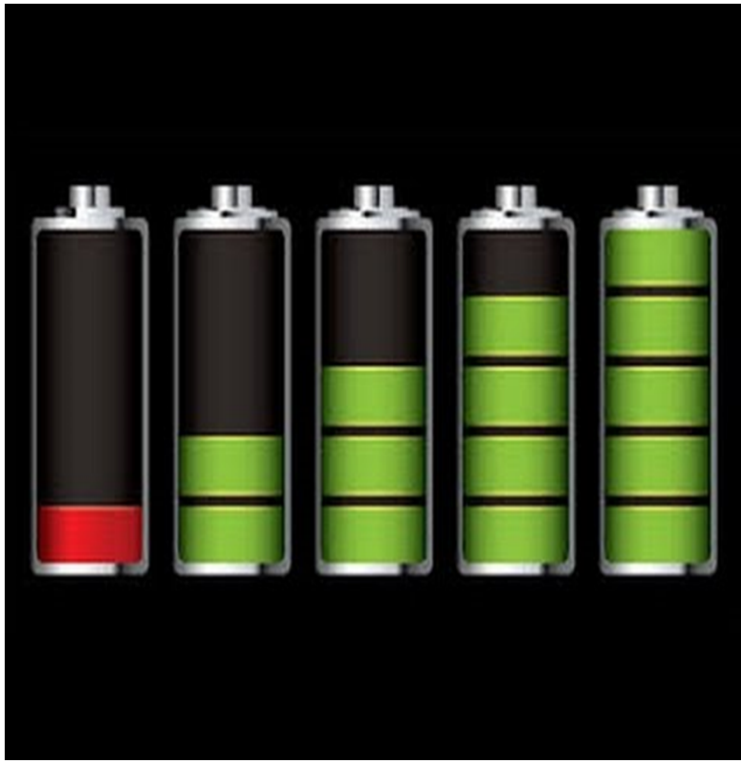
# Security

- Phone security is a big topic right now
  - Lots of issues surrounding the topic
- SSL Encryption
- Filters to remove user identification

# Results

System Performance

- Duty-cycle time - 30 minutes
- Minimize Battery usage
  - Apple IPhone 4 - 24 hours
  - Nexus 1 - 40 hours



# Results

Personal Points of Interest

- Generated by application and users records *Vibe it!*
- Use dampening region of 11 meters
  - Prevents localization error
  - Optimal for indoor locations

(a) Live view on the iPhone. (b) Historical view on the iPhone.

**Figure 3. VibN live and historical views on the iPhone.**

# Machine Learning

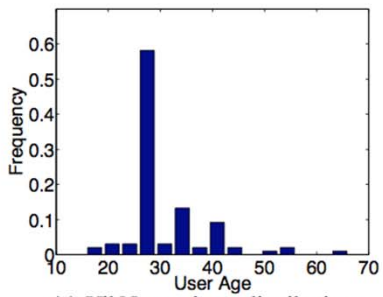
Backend Clustering

- Computes LPOI through DBScan technique
- Two Parameters
  - Scope of clustering - eps
  - Minimum number of data points - k

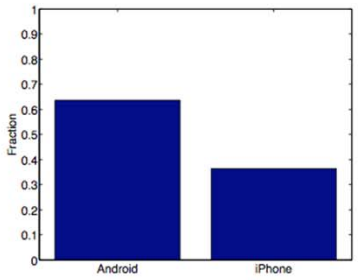

**Figure 4. Backend clustering algorithm performance: a) raw location data from seven different places; b) result of the clustering algorithm with k=1 and eps=0.1; c) result of the clustering algorithm with k=1 and eps=0.02; d) result of the clustering algorithm with k=5 and eps=0.002**

# VibN Usage Characterization

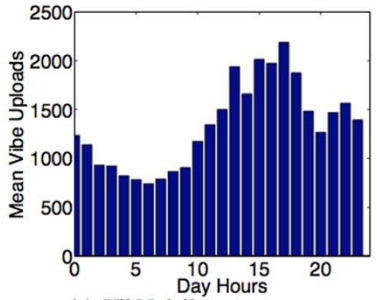
- Age Distribution
- Pattern Usage - Responsiveness
- Slower user base growth and data collection
  - Android and Apple Users - 25% participating



(a) VibN users' age distribution.



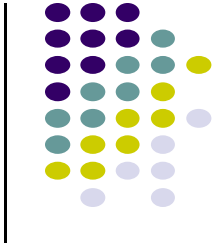
(b) Fraction of Android Vs iOS users.



(c) VibN daily usage pattern.

**Figure 6. VibN usage characterization.**

# Conclusions



- Allows the user to view active hotspots around the city
- Introduces the user to historic points of interest around them
- Provides the user with a diary of locations that they actively visit

# Future Work

- Allow users to personalize aspects of the app, such as what is determined as “significant”.
- Automatically infer demographic information, so as to limit manual input

# References


- *VibN Portal.* http://sensorlab.cs.dartmouth.edu/vibn

- ***Tapping into the Vibe of the City Using VibN*** Emiliano Miluzzo, Michela Papandrea, Nicholas D. Lane, Andy M. Sarroff, Silvia Giordano, Andrew T. Campbell, In Proc. SCI 2011, co-located with Ubicomp 2011