An Efficient Meet-Up Mechanism by Mashing-up Social and Mobile Clouds

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Objective: Provide immediate and personalized LBS information for a group of users.

Real-time meet-up activities for a group of mobile users
- Integrating GPS, cloud computing, smart phone and wireless communications.
- A on-line LBS service beyond the combination foursquares.com and latitudes.com.
Mashup Clouds for Mobile Social Networks

Mobile Networks
- Cloud Platforms: Facebook, MSN
- System Components: Community Engine
- Functions: 1. Group Event Announcement
  2. Group Membership

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Mobile Devices
- GPS
- 3G/LTE
- WiFi

NCTU Cloud Platforms
- Cloud Platform: Hyper-v
- System Components: JOIN Engine
- Functions: 1. Mobile User Location Database
  2. Area Interesting Events Advertisement
  3. Location–based Group Scheduling
  4. Speech Recognition

Network Connections:
- Cloud Platforms to Mobile Devices via GPS, 3G/LTE, WiFi
- Mobile Devices to NCTU Cloud Platforms via Internet
JOIN Client Architecture

- Software Design and Using:
  - Android Developer
  - WP7

- Hardware Using:
  - Smart Phone
  - Location
    - GPS (satellite fix)
    - AGPS (base station fix)
    - Sensors
  - Communication devices:
    - WiFi
    - 3G / LTE

![Diagram showing communication functions: GPS/AGPS, WiFi, LTE/3G, Data Collection, Data Analysis, Information Update, No-Touch Mechanism, GUI]
JOIN Cloud Architecture

NCTU Cloud Platforms

- JOIN engine:
  - Location database
    - Current and historical locations of each user
    - Dynamic calculation of distance among friends
    - Static locations of stores related to interested groups
  - Group membership and polling
  - Event Scheduling with data mining

Social Networks

- Community engine
  - Group Event Announcement
  - Group Scheduling
Developed mechanisms for mobile meet-up

- Calendar Merge-Up Mechanism
- Meet-Up Voting
- Location Pushing-Up Mechanism
- Proximity-Based No-Touch Mechanism for voting
JOIN can search the common available time for each user in their calendar.
**Meet-Up**

<table>
<thead>
<tr>
<th>Allan</th>
<th>Babara</th>
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<tbody>
<tr>
<td></td>
<td>Meet-Up</td>
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</table>

**Events**

- **Allan**
  - PDC2008
  - Election Day
  - Veteran's Day

- **Babara**
  - Labor Day
  - Veteran's Day
Calendar Merge-Up Mechanism (Cont.)

- Finding longest common subsequence (LCS) on MapReduce
- Mapper: Find LCS between two users
- Reducer: Combine the result

```
AACBBACD
CBCBBACD
CABDACA
ACBDDDCB

CBBACD

CBBACD

ABD

AD
```
Map Reduce Technique

Windows Azure with MapReduce

Meet-Up Voting

- Users can hold an activity.
  - vote for destination and time.
- Server can also proactively schedule the Meet-Up activity.
Location Pushing-Up Mechanism

- Location Pushing
  - Destination is pushed to each user with route planning.

- Reservation
  - Tickets
  - Rooms

- Booking in personal Calendar
  - Reminder
Let's meet here:
(24 N, 120 E)

You are here

Let's meet here

You are here
Proximity-Based No-Touch Mechanism for Voting

- Using touch screens are not safe for mobile phone users.
- Applying proximity sensors to initiate mobile applications without the need of touching the screen.
- Integrate with cloud speech recognition.

Proximity Sensor

Proximity-Based Action Decision Mechanism (PADM)

Cloud-Based Speech Recognition

Speech Confirmation Mechanism

Speech Recognition Result

Proximity-Based No-Touch Mechanism for Voting (cont.)

- Body language Translator

![Graph showing sensor values over time for 'Taking Phone' and 'Waving Hand' actions.](image)
Enhanced Location Privacy

- Providing location security in LBS system with ODB service model
- IMSI-based pseudonym to secure the location data in JOIN services
  - Provable security
  - Less Power Consumption
Used Techniques in Database

- Windows Azure Platform
  - Speech recognition server
  - Group scheduling server

- Network Coding for Location Privacy
  - IMSI-based JOIN secure mechanism

- VMs Load Balancing
  - Queuing theoretical resource prediction

Conclusion

- Present enabling mechanisms of meet-up applications for mobile phones, consisting of
  - calendar merge-up and polling mechanism
  - route information pushing-up mechanism
  - proximity-based no-touch mechanism
- Provide immediate and personalized social LBS information to mobile phone customers.
Reference


