E-SmallTalker: A Distributed Mobile System for Social Networking in Physical Proximity

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1. Introduction
2. System Design
   - System architecture
   - Thought of design
3. Implementation and Evaluation
4. Conclusion

Introduction

- Social gap in conversation
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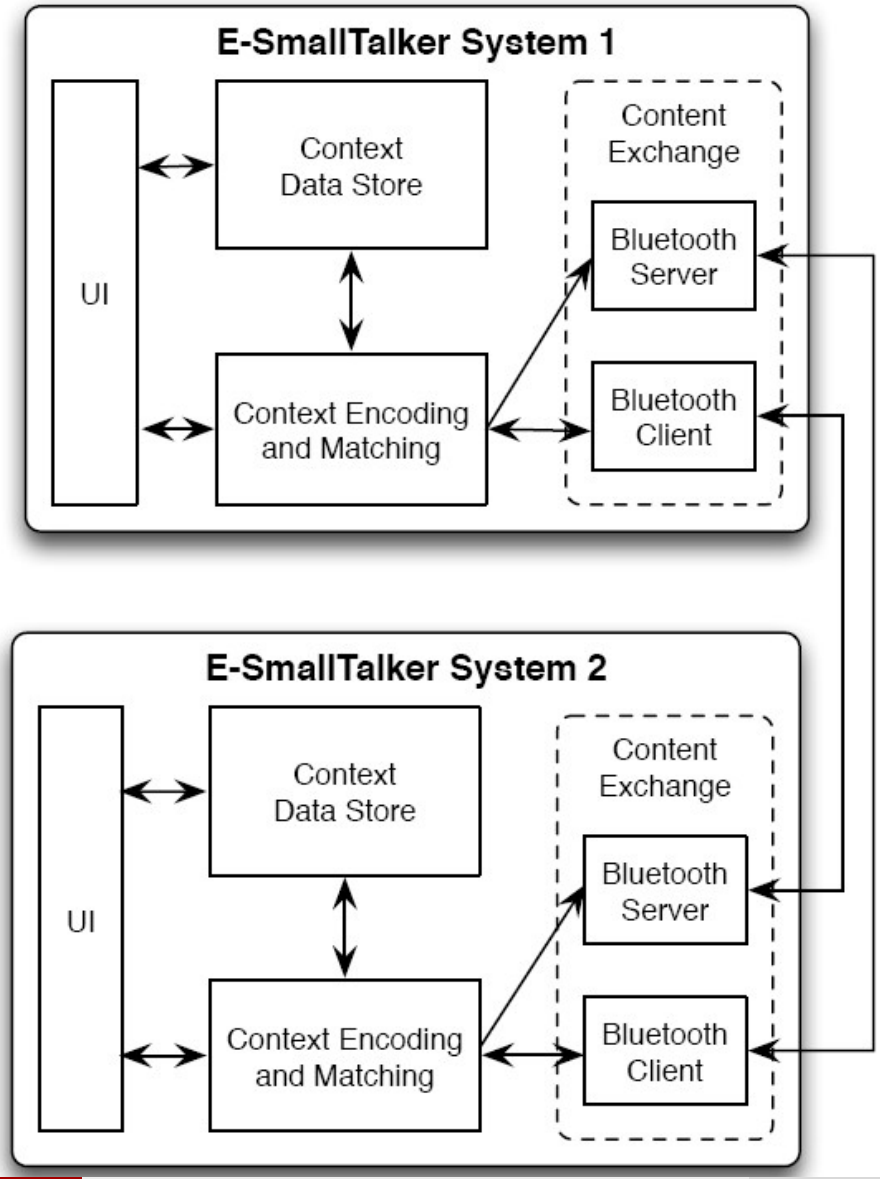
- Social gap in conversation
  - when people interact with strangers or unfamiliar parties
  - people unable to start up a conversation
- E-Small Talk
  - "small talk":shorten the social gap by starting the conversation with a common accepted topic
  - discover and suggest common topics for users

- Challenge
  - can be deployed on most commercial off-the-shelf (COTS) mobile phones
  - always efficient to gain other users' information for conversation
  - automatically suggest common topics without manual operation

System architecture



System Architecture

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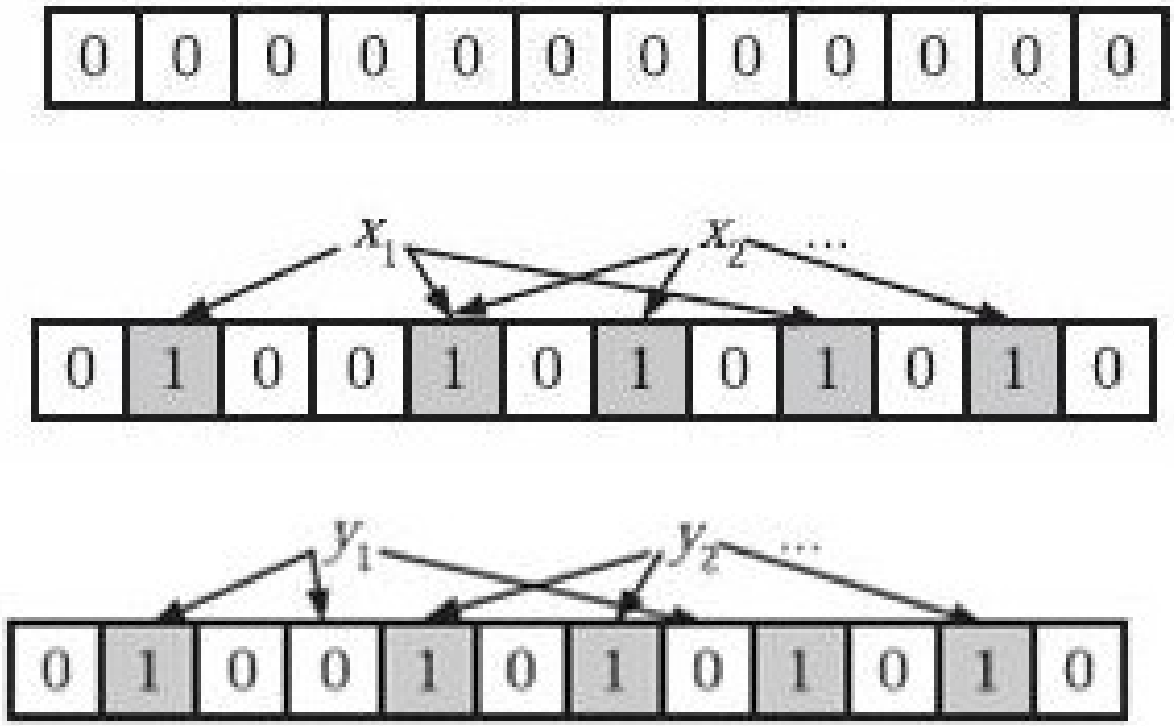
- User interface

Context encoding and matching

- problem formulation
  user set: $U = \{u_1, u_2, ..., u_N\}$
  users' interests topics set: $SetU_i = \{a_{i,1}, a_{i,2}, ...a_{i,N}\}$

Context encoding and matching

- Bloom filter
  A time and space efficient probabilistic data structure for testing whether an element is a member of a set.



Context encoding and matching

- Bloom filter
  - False positive data structure
  - false positive rate f:
    the probability that all the corresponding k bits for any given element are '1' although it is not really a member of the represented set

$$f = (1 - (1 - 1/m)^{kn})^k \approx (1 - e^{-kn/m})^k$$

- iterative discovery protocol
  - Initially:$SetU_A^0 = SetU_A$, $SetU_B^0 = SetU_B$
    encode them in two static Bloom filter BF_A^0, BF_B^0
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  - In the (r+1)th round, for A:
    - retrieve BF_B^r received
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    - encode $SetU_A^{r+1}$ into a new Bloom filter BF_A^{r+1} and published it
  - repeat such steps, until the new matching set is empty or the same as that of the last round or the desired false positive rate is reached

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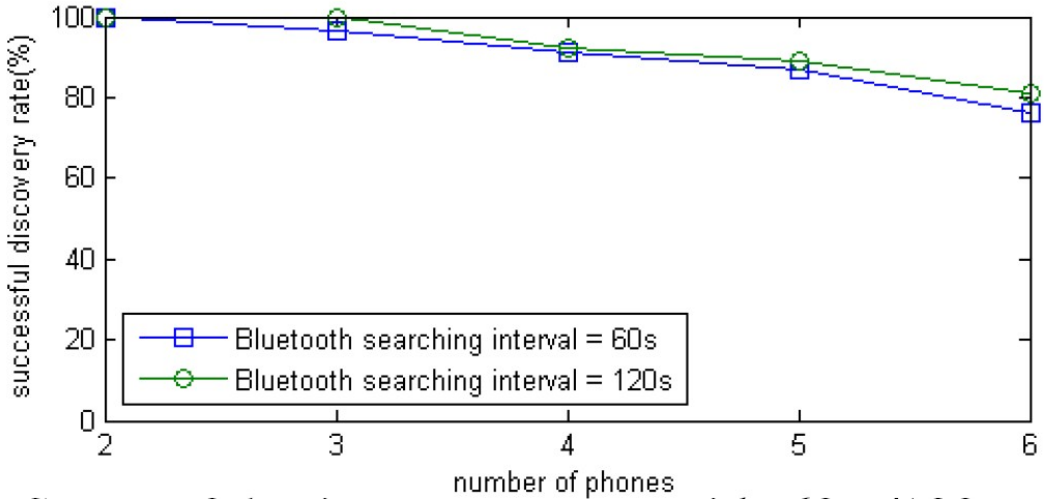
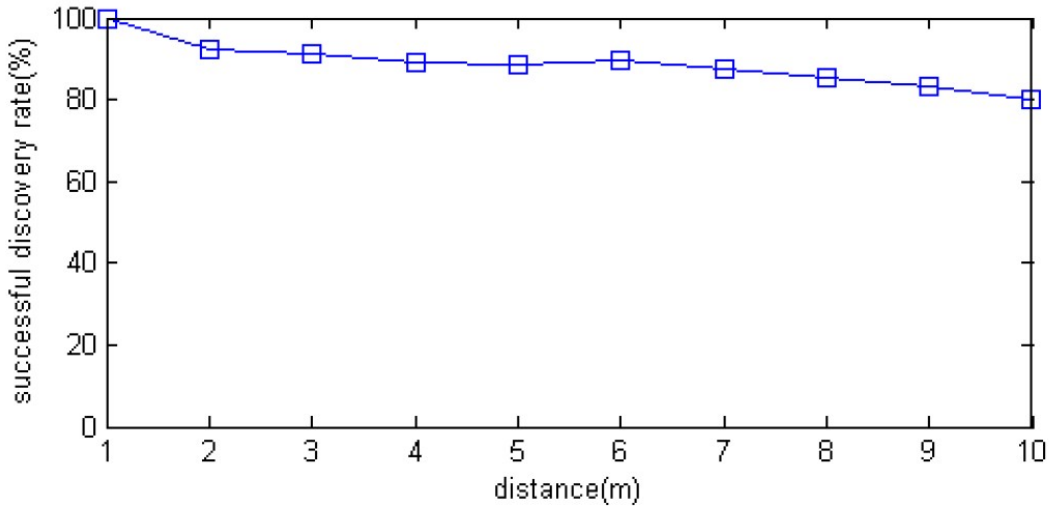
  - each service record consists of a list of service attributes
  - each attribute consists of an attribute ID and attribute value
- the approach making use of attributes
  - use attribute value to publish information
  - send an SDP request to gain the information maintained by the SDP server on another device

Implementation

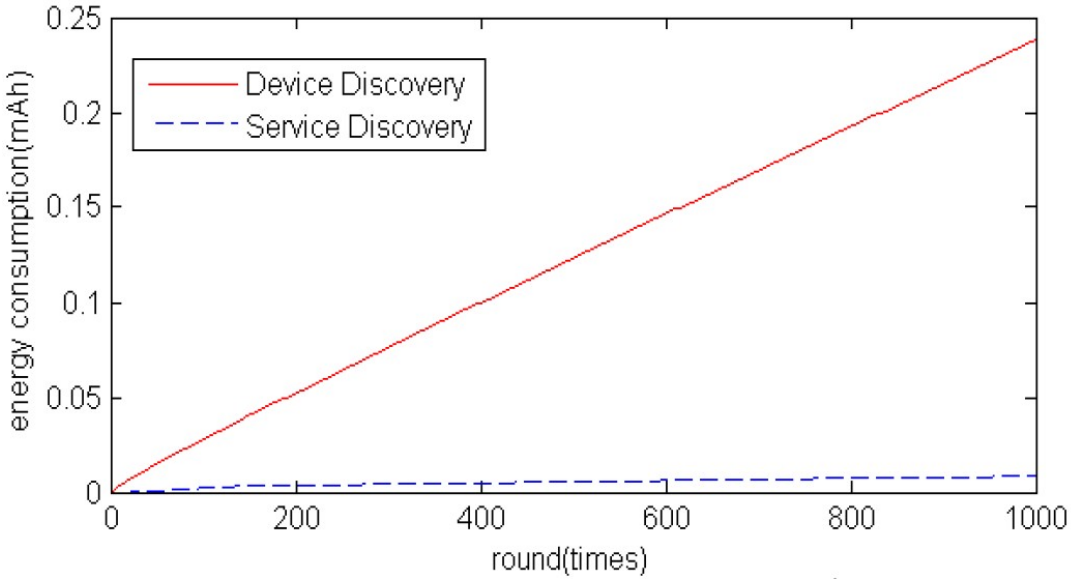
- Java ME: development environment
- implemented and tested on several brands of mobile phones
  Sony Ericsson (W810i), Nokia(5610xm, 6650, N70, N75, N82) ,...
- experimental setup:
  6 mobile phones
  each experiment repeated 10 times
  150 contacts per phone
  7 hash functions
- factors considered:
  the Bluetooth search interval
  the number of nearby device
  the distance between two devices

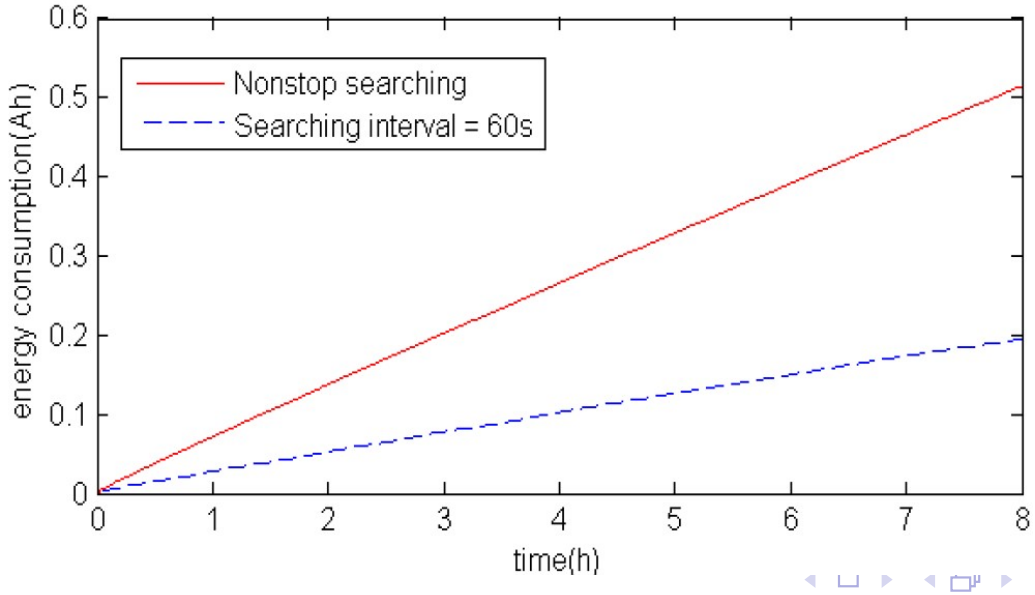
evaluation


successful discovery rate(%)
100
80
60
40
20
0
2
3
4
5
6
number of phones
Bluetooth searching interval = 60s
Bluetooth searching interval = 120s


successful discovery rate(%)
100
80
60
40
20
0
1
2
3
4
5
6
7
8
9
10
distance(m)

evaluation


0.25
0.2
0.15
0.1
0.05
0
energy consumption(mAh)
Device Discovery
Service Discovery
0
200
400
600
800
1000
round(times)


0.6
0.5
0.4
0.3
0.2
0.1
0
energy consumption(Ah)
Nonstop searching
Searching interval = 60s
0
1
2
3
4
5
6
7
8
time(h)

- contribution
  - the novel iterative Bloom filter protocol to encode user information
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  - the novel iterative Bloom filter protocol to encode user information
  - the communication approach based on the usage of Bluetooth SDP
- what I learn
  - the thought to design an application based on the objects and the experience of users
  - the idea of innovative usage of other theory