Presentation Topics

1. Friend Finder Application Architecture
2. SOS – Emergency and Alert messaging system
3. Trace Processing – How and possible Usage
4. Profile-Cast Application architecture
5. Google Earth Simulation of user Density Distribution on UF-Campus
Friend Finder
Application Architecture
User's Public Profile → Bluetooth Communication → Bluetooth Receiver → Set Alarm on a user/device → Alarm DB

GUI:
- Generate Alarm using Sound, vibration or a msg
- Recommend encountered users for establishing friendship
- Bluetooth Scanner
- DB of Encounters

DB of Friends

Other Applications

Analysis of Encounters → Decision Engine
Sending On-Demand Stress Signal – An On-Campus Emergency Alert Service
School and College campuses are facing a perceived threat of violent crime and abuse attacks.

The current emergency, alert and public safety systems take centralized approaches and lack the essentiality to provide localized rescue services.
Motivation

- Sending On-Demand Stress Signal (SOS) application as an on-campus emergency and alert service that relies on localized responses.

- This system sends distress signals to few trusted nodes using **Bluetooth and WiFi**.
Decentralized approaches of multi-sensor devices (like iPhones), which are capable to connect in more than just one ways
  - exploited for personal safety.

Localized services based application.
  - tap local and surrounding help based on mutual trust and friend relationships
Login Patterns

![Graph showing login patterns over 24 hours. The graph indicates a peak in login activity around the middle of the day with a significant drop in the early hours and late hours.]
Scanning Time

Scanning Time

Distance (meter)

Time (seconds)
Message Size Delivery

Format size vs Connection + Transfer Time

Time (seconds) vs Size (Kilobytes)
Results

- As the message size increases. It takes longer to transfer the complete message.

- We have established an SOS Message format which is 184 bytes in size, we have observed very low transfer times over a range of 0 – 60 meters.
Connection Time

Connection Time (1st Hop)

Time (seconds)

Distance (m)

0 10 20 30 40 50 60 70 80

0 5 10 15 20 25

Graph showing the connection time (1st hop) as a function of distance.
Successful transfer of SOS Message up-to 60 meters can be achieved in less than 5 seconds.

Beyond 60 meters, the time taken to establish a connection increases a lot due to increased interference.
Expected Delivery Time

Expected Delivery (1st Hop)
Result Analysis

- Up-to 60 meters, we can achieve successful communication within 15 seconds of time.

- Proposed application is efficient for SOS message transfer up-to 60 meter range.
Connection Time

Connection Time (1st & 2nd Hops)

- Time (seconds) on the y-axis
- Distance (m) on the x-axis
- Blue line represents 2nd Hop
- Yellow line represents 1st Hop

Distance vs. Time Graph for 1st and 2nd Hops.
Result Analysis

- That basic metrics like scanning time etc., take the same time for both 1\textsuperscript{st} and 2\textsuperscript{nd} Hop.

- SOS Message up-to 60 meters can be achieved in less than 15 seconds
Expected Delivery Time

Expected Delivery (1st & 2nd Hops)

Time (seconds)

Distance (m)

5 10 20 30 40 50 60 70 75

1st Hop

2nd Hop
Result Analysis

- Overall increase in the delivery time from 1st Hop to 2nd Hop Delivery is almost double.

- Up-to 60 meters, we can achieve successful communication within 25 seconds of time and thus, our application is efficient for SOS message transfer up-to 60 meter range.
Bluetooth Vs. WiFi

Connection Time

Time (sec) vs. Distance (m)

Wi-Fi
Bluetooth
File Transfer with Node Motion

Time (sec)

Distance (m)

File Transfer with Node Motion

- Under 5 Miles/Hr
- 5-10 Miles/Hr
- 10-15 Miles/Hr
- 15-20 Miles/Hr
System Architecture of SOS Application
The hardware interface provides connectivity with available radio technologies on the device.

- Current Implementation - Bluetooth
Protocol Stack

- User Input
- Trust Model Input
- Env. Sensed Attributes
- Historical Data

Decision Support System
- Trust Magnitude
- Type of Distress Signal
- Severity of Distress

Communication Paradigm
- Choice of Communication
Profiler And Connectors

- User Interface Input
  - Trust Model
- Distress Message
- Rule Engine
- Classifier
- Profiler
- Data Collector Engine
- Server Connector
- Environment Sensed Data
  - Rules
  - Data Storage Unit
  - User Profile
Trust Model

- Trust model is a rule-based classifier that recognizes Bluetooth encounter and assigns them into various classes of trust.

1. Location and vicinity information of Bluetooth encounter

2. Tags that define the level of trust with an encountered device. These tags are similar to ranks and status quo of a person, i.e. doctors, security personnel

3. Duration, frequency and clock time of the encounter

4. Devices encountered from the contact address books; and

5. Activity based encounters, which describes the circumstances when Bluetooth encountered happened.
Q1: Select Emergency Type and write Message?

- Physical Harm
- Burglary
- Medical Emergency Help

-Optional Message-

Submit
First line of Message will inform the receiver about expected response.

Level of Emergency - Based on Application scanning time/range, message size/format, etc. can be modified.

ID can be useful for emergency response teams.

Contact Info can be revealed to Trusted Nodes or kept hidden from Acquaintance/Stranger Nodes.

Location Info can be precise or relative as per Trust Requirements or Level of Emergency

Eigen Vector Information Matching is used to find the similarity between nodes.
Trace Processing
## Typical Trace Structure

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<th>Start Time</th>
<th>Location/AP</th>
<th>Duration</th>
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Possible Usages

- Generating Association Matrix
- Encounter Matrix
- Google Earth Location Density Maps
- Hourly, Weekly, Daily... Usage of Users
- .....
Profile-Cast Application Architecture
Location Map (downloaded or acquired)

User Profile:
- Library: 30%
- CS Building: 25%
- Sports Complex: 15%
- Infirmary: 10%
- Law School: 20%

Localization (AP-based, Landmark or GPS)

Message | <Message ID>
--- | ---
123-23-2
111-64-5
243-45-6
543-30-7

List of Messages

Profile Comparison System

Target Profile:
- Hospital: 30%
- ECE Building: 25%
- Sports Complex: 20%
- Infirmary: 20%
- Law School: 10%

User Profile:
- Hospital: 30%
- ECE Building: 25%

Bluetooth Interface

Message | <Message ID>