Using NFC-Enabled Mobile Phones for Public Health in Developing Countries

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IRD NFC Project Overview

• Interactive Research and Development (IRD)
  – A non-profit based in Karachi, Pakistan
  – Sponsors of IRD: Johns Hopkins University and PATH

• Objective: *Implement real-time electronic disease tracking system in developing nations*

• MIT Students’ Role
  – To create a functional prototype for IRD
Background

• Pneumonia kills more children under 5 years than any other disease
Towns
Korangi, Landhi and Bin Qasim

Population
1.2 million +

Primary care clinics
139

Vaccine centers
32

Major hospitals
9
Existing Conditions and Challenges

- Physicians
- Identification / Records
- At clinics
  - Spotty wired internet
  - Unstable electricity
  - Good wireless data coverage at clinics
- At central server facility
  - Dependable internet
  - Stable electricity
Prior Methods and Challenges

- **Paper-based System**
  - Slow and inefficient
  - Immediate alerting not supported
  - Costly (>400,000 paper sheets)
  - Highly dependent on quality of printing
  - Scanner burn-outs (4 replacements)
  - Unique ID errors: linking data forms manually
## Prior Methods and Challenges

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Mother's first name?</td>
<td>NADJA</td>
</tr>
<tr>
<td>5. Mother's last name?</td>
<td></td>
</tr>
<tr>
<td>6. Father's first name?</td>
<td></td>
</tr>
<tr>
<td>7. Father's last name?</td>
<td></td>
</tr>
<tr>
<td>8. Child's first name?</td>
<td></td>
</tr>
<tr>
<td>9. Child's last name?</td>
<td></td>
</tr>
<tr>
<td>10. Child's sex:</td>
<td>Male</td>
</tr>
<tr>
<td>12. Today's date:</td>
<td>02/02/2006</td>
</tr>
<tr>
<td>13. Immunization given:</td>
<td></td>
</tr>
<tr>
<td>14. Next visit for:</td>
<td></td>
</tr>
<tr>
<td>DPT1/OPV1 if BCG in 13 or DPT2/OPV2 if DPT1/OPV1</td>
<td></td>
</tr>
<tr>
<td>15. Allotted Date of next visit:</td>
<td>02/03/2006</td>
</tr>
<tr>
<td>(6 week from BCG or 4 week from DPT1/OPV1)</td>
<td></td>
</tr>
<tr>
<td>16. Which EPI center would you like to visit for next immunization of your child?</td>
<td>05/11/2006</td>
</tr>
</tbody>
</table>

**Notes:**
- Child Not Named Yet (go to 10)
- Child's date of birth format: DD/MM/YYYY
- Immunization given format: BCG/OPV0, DPT1/OPV1
- Next visit for: DPT1/OPV1 if BCG in 13 or DPT2/OPV2 if DPT1/OPV1
- Allotted Date of next visit: 02/03/2006 (6 week from BCG or 4 week from DPT1/OPV1)
- Which EPI center would you like to visit for next immunization of your child? 05/11/2006
Prior Methods and Challenges

- First Electronic Approach: Health worker with a PDA
  - More accurate data gathering
  - But no accurate ID
  - Needs extra health worker per clinic

- Still needs system that does not require additional manpower while remaining accurate, scalable, affordable
Our Solution

No Pneumonia

Pneumonia

Severe Pneumonia
Video

Interactive Alerts Pakistan
Architecture

- **Step 1**: Patient Identification
  - Two Options:
    - Enter ID By Hand
    - Passive RFID Scanning

- **Step 2**: Condition Diagnosis
  - Pneumonia Diagnosis List

- **Step 3**: Communication
  - HTTP/HTTPS Over GPRS
  - Diagnosis Notification Script
    - (Three Options)
      - log.txt
      - Email/SMS notification
      - RDBMS notification

**Nokia 6131 NFC J2ME Module**
- Integer Patient ID
- String Describing Diagnosis
- <ID, Diagnosis>
Advantages

• Quick and accurate ID
• Automatic logging to longitudinal health record of patient
• Enables immediate alerts and notification of support team
  – Enables team to immediately pick up patient, collect samples, and administer treatment
• Affordable
  – Approx. USD 200 / phone
  – < USD 2 / bracelet
• Easy to maintain
  – Phone batteries avoid electrical problems
  – Phones are relatively easy to replace
Real-World Use

- MIT students completed the end-to-end prototype
- IRD software developers integrated and extended technology
- Nokia sponsored NFC phones for deployment
- Now in use, since Dec 2008
  - 20 PCP clinics already deployed, more soon
  - Over 1000 children already enrolled
  - Potential for more children
Future Work

- Continue and extend application in IRD’s operations
- Public health data collection and surveillance, outbreak prediction.
- Use same phone for pharmaceutical inventory control
- Use to populate medical records
  - Increase the scope of illnesses and treatments
Acknowledgments

- Omar Allawala and Julia Irani at IRD are extending and continuing the work at IRD
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- Jhonatan Rotberg director of Next Billion Network
Thank You

Questions