Mobile Wellness Toolkit Project

Richard Anderson
University of Washington
Problem statement

How do we make low cost consumer technologies available to organizations who implement health and wellness programs?

• Many opportunities to use consumer technologies for health and wellness services
  • SmartPhones, Tablets, Cloud computing, SMS, . . .
• Organizations innovating in the deployment of health services generally don’t have expertise in computing
Mobile Wellness Toolkit Project

- National Science Foundation project
- Partnership between University of Washington and PATH
- University of Washington
  - Richard Anderson, CSE
  - Gaetano Borriello, CSE
  - Beth Kolko, Human Centered Design and Engineering
- PATH
  - David Lubinski
  - Kiersten Israel-Ballard
  - Noah Perin
Mobile Wellness Toolkit

• Project goal:
  • Produce tools and platforms that allow organizations to develop and deploy low cost health and wellness solutions based on consumer technology

• Methodology
  • Work in partnership with health and field based partners
  • Iterative approach
  • Develop innovative technology
  • Deploy with partner in specific instance
  • Refine technology
  • Generalize to a re-usable component
Projects

• Data collection on mobile devices
• Task support
• Decision support: use of data
• Behaviour change communication
Integrated data collection
Open Data Kit

1. Build form
2. Collect data
3. Aggregate results

http://opendatakit.org
Expand ODK Capabilities

• Support simple databases on the mobile phone
  • ODK Tables

• Data from sensors, not just entered by humans

• Already exploit built-in sensors
  • Camera for photos, video, digitizing paper forms
  • GPS, barcode scanner

• Make it easy to add *external* sensors
  • Motivated by many apps we work on in our group
ODK Tables

- Visualization of underlying database
  - Support interaction with a database instead of just submission to a database
  - Sqlite database
- Data transfer
  - Synchronized with server tables
  - Shared tables between phones
  - SMS communication
- UI features
  - Join to other tables
  - Multiple views of data (maps, graphs)
  - ODK collect to edit row contents
Joined tables

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ODK Sensors

- **Build a user-level sensing framework with sensor drivers**
  - No operating system modifications
  - Allows convenient reuse between applications

- **Create a single sensor interface**
  - Access wired, wireless, and built-in sensors
  - Support multiple sensors over multiple channels

- **Focus on ease of deployment and development**
  - Distribution through existing app store model
  - Reduce complexity
  - Without adverse effects on performance
FoneAstra

• Sensor bridge for mobile phones
• Initial version for low cost phone, current efforts directed to Android phones
Practical, affordable breast milk pasteurization

- Temperature probe monitors milk temperatures
- Android mobile app:
  - Collects donor information
  - Guides user through pasteurization process based on milk-temperature
  - Prints pasteurization report and labels for processed milk-bottles
  - Uploads temperature data to server for review by supervisors
Breast milk pasteurization

- Recognized health benefits of breast milk
- Milk banking an option when breast feeding not possible
- Providing safe breast milk in low-income regions is a challenge
  - Commercial pasteurizers are expensive
  - Low-tech methods lack quality control
Pasteurization process
Development of FoneAstra

- Initial interface board developed for basic phone in collaboration with MSRI
- Deployment in Albania for vaccine monitoring
- Identification of HMB application
- Prototype developed and tested
  - Process design work from HCDE students
- Interface board for Android developed
- Deployment in South Africa
  - Introduction of Bluetooth printer
  - Development of new interface board to support battery powered use
ODK Scan

- Many organizations in developing countries rely on paper forms to collect data.
- However, paper-based data is difficult to transport, analyze and aggregate.
Form input with mobile phone camera

- Users take a picture of the form using a phone camera
- Data automatically extracted from the image
- Multiple choice “bubbles” and checkboxes digitized with 99% accuracy.
- Image snippets displayed on the screen to make it easier to enter text.
- Integrated with ODK Collect
Deployments

- Technical implementation and initial evaluation completed
- Ongoing deployment with health workers in Mozambique
- User study quantifying the benefits of digitizing data
Task support
Job Aids: Smartphone Apps for health workers

How To Do the Rapid Test for Malaria

[Images of a rapid malaria test and a smartphone app demonstrating the test steps]
Job Aid framework

- Functionality for job aids
  - Clear wayfinding
  - Decision trees
  - Calculators
  - Timers
  - Animated images
- Environment to support creation of electronic job aids by non-programmer
- Usability considerations critical
- Is ‘hands free’ operation possible?
Point of care diagnostics

• Rapid diagnostic tests (RDTs) quickly test for conditions based on blood/urine sample
• Supportive tools to aid health workers with the administration and interpretation of these tests.
Android based point-of-care diagnostic system

Diagnostics aids health workers in 3 ways:

1. As a platform for creating digital job aids for RDTs.
2. By automatically interpreting the test results using computer vision algorithms running locally on the phone.
3. By automatically collecting data about the type and outcome of the RDT.
Project status

- Technical implementation and initial evaluation completed
- Initial results suggest that the system is ready to be field tested with health workers.
- Study based on optical samples from organization deploying wide range of RDTs.
Pulse Oximetry for detection of childhood pneumonia

- Include blood oxygen readings into Integrated Management of Neonatal & Childhood Illness
- Protocol implemented on Android tablet
- Connection with bluetooth and USB pulse oximeters
Decision making:
Use of data
Supervision Support for Community Health Workers

- CHWs responsible for household visits
- Supervisors track performance and deliver feedback
- Mobile phones used by CHWs for data collection
  - Commcare, application developed by Dimagi
- Augmented to send CHWs images showing performance
Sending performance feedback

Individual feedback

Peer comparison
Health system visualization
Health system inventories

- National database of health facilities, assets, and indicators
- Example, Kenya cold chain inventory, 4,000 facilities
  - Facility information
    - Demographics
    - Infrastructure
  - Cold chain equipment
    - Refrigerators with status
    - Cold boxes
    - Other equipment
- Challenge
  - Make this information available for management
  - Support simple modeling
    - Add a new vaccine to the routine immunization - how does that impact required cold chain capacity?
Vaccine cold chain

- Refrigerators for storing vaccines
- Important component of immunization system
- PATH developed Cold Chain Equipment Manager
  - Inventories of multiple countries in Africa
  - Support for India cold chain assessment
Health System Visualization Tool

- Support national and regional managers in decision making
  - Geographic visualization
  - Simple modeling
- Usability and meeting stakeholder needs central to project
- Technical challenges
  - Allowing customization for multiple data sets
  - Easy to use mechanism to support modeling
  - Visualization of multiple indicators at same site
    - E.g., energy sources, population, refrigerator types, capacity shortages
- Browser based implementation supporting online and offline use
  - Likely to use D3 for visualization

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Behaviour Change Communication
Reminder and Encouragement Systems

• Messaging systems to clients
  • Assume basic mobile phones (SMS + Voice)
  • Escalating reminders (SMS followed by voice) more effective than just SMS
• Two way messaging – soliciting response by SMS
• Evaluate impact of different approaches to messaging
• Develop backend to support complex messaging
Testing SMS messages

**Control Group**
No intervention.

**One-way SMS**
Pregnant woman receives twice-weekly SMS with health information relevant to her health and her stage of pregnancy.

**Two-way SMS**
- Pregnant woman receives twice-weekly SMS requesting a reply.
- Hypothesis that woman’s reply can be a proxy for engagement and uptake of health services.
Web-based system for managing messages
Digital Public Health

- Health education based on community created video
- Build on model developed by Digital Green
- Projects in Seattle and Uttar Pradesh
Community Video Education

- Video based education where content is both created and presented by the community
  - Localization of content and messaging
  - Community engagement and empowerment
- Enabled by low cost consumer digital video technology
Piloting Digital Public Health

Pilot objectives

• Develop a strategy for implementation
• Assess and evaluate feasibility of integrating mobile videos into routine community-based support

Digital Green, PATH, Sure Start Partnership

• Community based partner, Gram Vikas Sansthan
• Bachhrawan Block, Raebareli District, Uttar Pradesh, India

Focus on maternal health messaging using SureStart materials

Develop methodology in 20 villages
Thanks!

- anderson@cs.washington.edu