Mobile Wellness Toolkit Project

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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

Computing and Global Health

- Broad interest in introducing computing based solutions to health challenges
- Rapidly changing technological landscape

Applications of Information and Communication Technologies

- Portable medical devices
- Medical record systems
- Disease surveillance
- Data collection
- Supervision
- Reminder systems
- Case tracking
- Logistics management
- Behavior change communication
- Digital imaging and telemedicine

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
PATH
- Seattle based NGO working in health technologies
- Founded 1977
- Now working in 70 countries
- Program for Appropriate Technology in Health
- Approximately 1000 employees world wide, 400 in Seattle
- Five offices in India
  - Delhi office in Qutab Institutional Area

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-useable component

Projects
- Data collection on mobile devices
- Task support
- Decision support: use of data
- Behaviour change communication

Integrated data collection

Open Data Kit
- 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

http://opendatakit.org
**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
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

Deployment

- 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

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

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

Decision making: Use of data
**Sending performance feedback**

**Individual feedback**

![Graph showing individual performance](image1)

**Peer comparison**

![Graph showing peer comparison](image2)

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**Health system visualization**

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**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?

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**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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**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

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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

<table>
<thead>
<tr>
<th>Control Group</th>
<th>One-way SMS</th>
<th>Two-way SMS</th>
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- Two-way SMS: 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
- 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!

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