

Mobile Wellness Toolkit Project

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University of Washington

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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

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Computing and Global Health

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









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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

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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



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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



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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



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Projects

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


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Integrated data collection

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Open Data Kit


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



<http://opendatakit.org>

Expand ODK Capabilities

- 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



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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



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FoneAstra

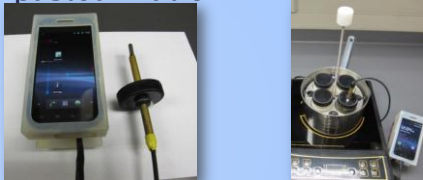
- Sensor bridge for mobile phones
- Initial version for low cost phone, current efforts directed to Android phones



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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

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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



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Pasteurization process



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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



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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.



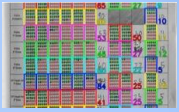




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Form input with mobile phone camera

- 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








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Deployments

- Technical implementation and initial evaluation completed
- Ongoing deployment with health workers in Mozambique
- User study quantifying the benefits of digitizing data

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Task support

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Job Aids: Smartphone Apps for health workers




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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?





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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.



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Android based point-of-care diagnostic system

Diagnostics aids health workers in 3 ways:

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






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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.






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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

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Decision making: Use of data

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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

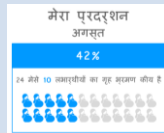


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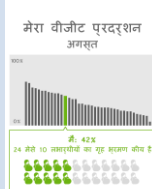
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Sending performance feedback

Individual feedback



Peer comparison



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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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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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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

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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

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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

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Digital Public Health

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

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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

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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

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Thanks!

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