Data Collection and Information Management for Rural Development

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Financial Services for the Poor

Microfinance: Global Movement
- Grameen Bank & Muhammad Yunus – 2006 Nobel Prize

Self-Help Groups (SHGs) - ROSCAs, ASCAs, Village Bank, etc.
- Collect savings during meetings
- Use capital for small loans
- Business, livestock, education, health care, etc.
- Repayment based on peer pressure

Decentralize financial service provision

Linking Formal and Informal

SHGs are being linked to banks
- Access more credit at better rates
- Other services (insurance, investment, savings, etc.)
- Local intermediation can reduce cost of service
- Excellent repayment performance (90-98%)

However, many obstacles (ICTD 2006)
- Spread across remote rural areas
- Limited education, infrastructure, financial capacity
- Documentation practices are inconsistent
- Difficult to assess credit risk and make decisions

Information can be the Bridge

Information can bridge the divide
- Connect the formal and the informal
- Provide oversight and understanding for SHGs
- Provide credit ratings and risk analysis for banks
- Result: SHGs get better rates for better performance

Can we design a system for SHGs to aggregate data?
- Accessible to users
- Accurate and efficient
- Intermittent power, connectivity
- Generalizes to other applications

Design for Rural Users

Investigate interface design space for rural users
- SHG members and supporting staff
- Some may be semi-literate or illiterate
- Use SHG data collection as sample application

Only previous work was Grisedale et al., CHI 1997
- Data collection for rural health care workers in Rajasthan
- Using Apple Newton

We used laptop / PC for maximum flexibility
- Not considering real deployment issues

Step 1: Understand

2002-3
Two-month iterative design study conducted in a village

32 rural users - farm laborers (10 semi or illiterate)

- Paper formats are important
- Local language audio builds trust
- Numeric input/output is accessible
- Guide the user through the task
- Realistic icons are better
Step 2: Build

2004-5

2) Mobile Phones

Mobile phones are the perfect client device
- Exponential growth across developing world
- Numeric Keypad, Speakers & Microphone
- Intermittent network, Battery-operated, Low-cost
- Supports Agent-based service model

Problems and Limitations
- Small screen: adapted WIMP metaphor
- Numeric keypad: text entry is difficult
- Difficult to program applications

Mobile phones are the perfect client device

13

Villages  Agents  Services

1) Agents - Rural Service Providers

Agent Model: Provide services through local intermediaries
- Employ underemployed youth and women
- Convenient for users / clients (travel is hard!)
- Common motif for many services
  - Primary health care
  - Retail supply chains
  - Agriculture
  - Communications, etc.
- In microfinance, {bank, NGO} field staff collect info, repayments & deliver reports

1) Agents - Rural Service Providers

3) Paper User Interfaces

Leverage affordances of paper in digital UIs
- XAX, Digital Desk, A-Book, Paper PDA, Cooltown, Books with Voices, etc.

However, thus far these approaches have had limited impact

Rural developing world could be the killer application
- Familiarity with paper formats
- Offset high technology cost by performing some operations on paper "client"


CAMForms interactive paper forms

CAMBrowser mobile phone app to process forms

<function name="a_click">
  d = input_date("Date", "date.wav");
  i = input_int("Interest", "int.wav");
  p = input_int("Principal", "pri.wav");
  if (d & p & i)
  http_put("...");
</function>

CAMScript scripting language for form interaction

CAM: Key Features

- Tight linkage to paper practices
  - Retain paper as the authoritative local record
  - Avoid abstract, menu-driven interaction
  - Not optimizing for local labor — don’t need OCR!

- Simple, scripted programming model
  - Easy to program and use

- Multimedia Input & Output
  - Capture audio and images instead of text

- Disconnected Operation
  - Transfer data using SMS, MMS, Email (and HTTP)

```javascript
function a_click()
  date = input_date("Enter Date", "date.wav");
  amt = input_int("Enter Amount", "amount.wav");
  message_note("Say your name", "sayname.wav");
  record_audio("name.wav");
  email("tap2k@yahoo.com", "a="#amt, "name.wav");
</function>
```

CAM: Data Flow in Microfinance

- Framework for SHG data collection and reporting
- Increased transparency within SHG
- Improved documentation when applying for loans
- Provide new services to members (e.g. flexible savings)
Step 3: Evaluate

CAM: Usability Evaluation
Parikh et al. - ACM CHI 2006

**Task:** Record transactions during SHG meetings
- Users: 14 field agents from NGO
- 7th grade to college educated
- Simulated and in situ testing

**Results:**
- Learnable: Learned within 1-3 sessions
- Efficient: 30 secs per form, 8-10 mins per meeting
- Accurate: Error rate < 1% (0% for in situ tests)
- Users performed significantly better with audio

CAM: Impact in Microfinance
Commercialized by ekgaon technologies pvt.ltd
2 NGOs / 17 agents / 700 SHGs / 10000 members
In active use in Tamil Nadu since October 2006

Beyond Microfinance

**Supply Chain**
Javid and Parikh - ICTD 2006
- Monitor inventory at rural warehouses
- Plan collection & distribution
- Tested in Uttar Pradesh, India

**Public Health**
DeRenzi et al. - ACM CHI 2008
- Automate clinical protocols
- Reduce training, improve adherence
- Tested in Tanzania

**Agriculture**
Schwartzman and Parikh - MobEA 2007
- Monitor cultivation using pictures, audio
- Provide extension and certification
- Pilot w/ 1000 coffee farmers in Mexico
Agriculture: Digital ICS
Schwartzman et al. - MobEA Workshop at WWW 2007

Internal control system for agri-cooperatives
Maintain quality, certifications (organic, fair trade)
Pilot w/ over 1000 small farmers in Oaxaca, Mexico

Inspectors use mobile phones to monitor farms
Evaluators use a web application to give feedback
Generate reports for extension and certification

OpenRosa Consortium
Building mobile tools for public health
Standards-based (XForms), Open Source

Applications
- Disease Surveillance
- Clinical Protocols
- Clinical Trials
- Household Surveys
- Birth and Death
- Support CHWs

Organizations
- OpenMRS
- EpiHandy
- EpiSurveyor
- Berkeley
- MIT
- Cell Life (South Africa)
- MRC (South Africa)
- IRD (Pakistan)
- Dimagi
- D-Tree

Future Work: Support Local Creators
Empower local people to build their own solutions
Physical tools for content creation and application development
Paper formats, visual and tangible programming

Future Work: Trust & Ownership
Rural users may never “own” technology
How do different identification technologies, interaction mediums and social contexts impact trust in computing?
Can we facilitate distant personal / business relationships?

Final Thoughts
Design for real people & problems
Attracts diverse & energetic students
Impact sustains credibility & collaboration
Thanks for all the Fish

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ekgaon technologies

ekgaon was founded in 2002 and works in providing technical, managerial and strategic support to community-led initiatives around India and the world. Currently we are based in New Delhi with a field office in Madurai, Tamil Nadu.

http://www.ekgaon.com

Other Partners and Supporters

- Covenant Centre for Development
- Mahakalasm SHG Federations
- CARE India
- Deutsche Gesellschaft for Technische Zusammenarbeit (GTZ)
- Small Enterprise Education and Promotion Network (SEEP)
- International Development Research Centre (IDRC)
- Sarai New Media Initiative
- Ricoh Innovations
- Microsoft Research
- Intel Education Program

Honey Bee shares grassroots knowledge and innovation
- Publishes 7 regional magazines about agricultural practices and other innovations
- Interested in new ways to share content and facilitate communication
- Developed multi-media distributed database and communications application
- Networked using asynchronous CD-based updates
- Implemented at kiosks in Gujarat, Madhya Pradesh, Maharashtra and Tamil Nadu

Knownet-Grin

Knowledge Network for Grassroot Innovators: A Honey Bee Project
Under five mortality was 13% less in two districts implementing IMCI.

Source: Armstrong et al., 2004
3 billion people in the rural developing world need the same information we do

- Business: new opportunities
- Finance: capital to invest
- Government: services & programs
- Health: informed, consistent care
- Education: personal advancement

Outline
1 Background: Microfinance
2 Contextual Design for Rural Users
3 CAM: Data Collection for Mobile Phones
4 Evaluation: Usability, Breadth, Impact
5 Future Work
6 Conclusions

ICTD: An Emerging Area

TIER Group, UC Berkeley
- Long-distance wireless, DTN
- Mobile educational software

Digital Studyhall, Princeton / UW / MSR
- Video for education
- Postmanet – physical networking

Emerging Markets, MSR India
- Design for semi-literate users
- Multiple mice for education

One Laptop Per Child (OLPC)
- Laptops for education

Other Efforts
- MSR funded 17/162 proposals

3 billion people in the rural developing world have different limitations and capabilities

- Money: to buy technology
- Education: to use technology
- Infrastructure: power, connectivity
- Time: lots of available labor
- Community: lots of relations

Problems with Mobile UIs

User Interface
- Adapted point-and-click metaphor
- Text entry is difficult; limited use of other media

Mobile UI research has largely focused on improving display of web content on small screens
- WEST, PowerBrowser, Wingman, Digestor, AppLens, Summary Thumbnails, Collapse-to-zoom, etc.

Programming Model
- Proprietary APIs and programming environments
- Web-based applications require online connection

Contributions

Design Lessons for Rural Users
- Importance of paper
- Local language audio
- Numeric I/O

CAM Toolkit
- Paper user interface
- Multimedia I/O
- Scripted & asynchronous

CAM Evaluation
- Usability
- Generalizability
- Real-world impact
Overview & Methodology

Understand Context
A highly 'embedded' approach to designing, developing and evaluating technology

Build Solution
CAM: a mobile phone toolkit for distributed data collection in the rural developing world, and several applications using it

Evaluate Impact
Microfinance – actively used in India
Agriculture – pilot in Guatemala and Mexico
Public Health – tested in Tanzania

E-Z Rural Computing
Easy to Use: Max outreach
Easy to Teach: Word of mouth
Easy to Access: Travel is hard
Easy to Share: Amortize high costs
Easy to Create: Local ownership
Easy to Adapt: Localization essential

Public Health: e-IMCI
Integrated Management of Childhood Illness (IMCI)
Use of IMCI protocol can significantly reduce child mortality (Armstrong, 2004)
Automate using mobile device to reduce training, improve adherence

Tested with IHRDC in Mtwara, Tanzania
Measured adherence to the IMCI protocol
Observed 27 e-IMCI sessions, 24 paper-based sessions
Use of e-IMCI can significantly improve adherence compared to current practice
Preferred by all users

Long-term Vision
Equitable Economic Development
Environmental Sustainability
Freedom & Political Stability
Information Technology
Decentralization