**Problem**

Positively ID’ing patients/subjects and tracking care is essential to improving health outcomes, and is the foundation of virtually all research work (healthcare, or otherwise). Tracking patients’ medical care is difficult in isolated and developing areas:

- **Identification** - difficult without photo IDs / national identification schema. Complicated by:
  - Linguistic/cultural hurdles; eg, too few names in language to cover population, or villages with first names only.
  - Language barriers between providers and patients.
- **Medical Records** – Frequently non-existent or difficult to use and poorly kept.
- Nomadic populations and/or mobile clinics often render paper records valueless.
- Paper records are not very secure, often leading to poor record keeping.
- Lack of equipment, power, internet, funding, training, etc.

**Field Work**

- **iRespond (stakeholders) – meetings to discuss**
- Identification problems and how to design SIDs
- Platform/Interface Design. Decision to be as device agnostic as possible (browser-based, HTML5, JavaScript, SQL).
- iRespond’s preliminary testing in Thailand
  - ~80% success with initial scan (scanning through callouses of farmers was difficult), 100% success achieved after 2-3 attempts
- Other biometric possibilities. Palm scanning (used on ATMs in Japan, in lieu of ATM cards), iris scanning (for multiple amputees), vein maps, voiceprints.
- **UW CSE Machine Learning, Speech Group – to meet to discuss** voiceprints as a biometric. (Global validity inconclusive; group offered help on it next quarter.)

**Solution**

- **Biometric Patient Identification**
  - fingerprints, may use others in future where fingerprints are inappropriate
- **Device/Platform Agnostic Software**
  - low cost fingerprint scanner connects via USB
- **EMR in Cloud**
  - secure storage
  - access from anywhere in the world
- **Usable**
  - even with limited local language skills / low education
- **Globally Scalable**

**IRIS | Mobile Patient ID and Tracking**

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**Architecture**

To ensure security, care providers biometrically log in to access IRIS.

- **Secure Access Scan**
- **Patient Finger Scanned**
- **Cache**
- **Query Cloud**
- **Display and Interact with EMR**

**Components**

- **Device** – smartphone, tablet, laptop, etc.
- **Biometric Scanner** – presently, usb connected fingerprint scanner
- **IRIS System** – HTML5 / JavaScript interface
- **SQL Cloud Database with Two Tables**
  1. Table of fingerprint templates, and SIDs
  2. Table of SIDs, and patient EMRs [or log of GUIDs]
- **Local temporary caching of database allows work with poor connectivity**
- **SID/GUID system allows for near-completely automatic reconciliation of temporary records when re-connected**

**Determining SID Format:**

How to identify a single individual from an infinite pool of subjects and assign them a Subject ID (SID)

**Considerations for SID:**

- **Must** be anonymous and secure.
- **Must** be assigned randomly (rather than sequentially, or by country).
- **Must** be human-readable (manually transcribable, short, ‘Miller’s Law’).
- **Must** be globally scalable.
- **Must** be tolerant of internet network connectivity.
- **Must** allow for a system of temporary SIDs (that can still be used in temporary local storage and on paper in a clinic), that can be supplemented by real SIDs upon reconciliation.

**Solutions:**

- Verhoeff Check-Digit (to minimize transcription errors; final digit in SID).
- 12 digit SID, Arabic numerals only (universally input-able, excluding check-digit, up to 99 billion entries).
- Temporary SIDs only use numbers between 0 and <10 billion, so any SID with a leading zero is recognizable as temporary. On reconnection to the database, local data is reconciled with the cloud; assigning permanent SIDs or applying data to existing SIDs’ records.
- **Invisibly, system assigns GUIDs (Globally Unique Identifiers); 32 hexadecimal digits to fingerprint templates and SIDs. GUIDs have approaching-zero probability of duplicate random numbers even without checking the database first.”
- A log is kept of the temporary SIDs used, with what GUIDs, and when, allowing audit trail and reconciliation of orphaned paper records.

**Spring Quarter Timeline**

- **April**
  - Final Backend Development
  - Database, interaction with fingerprint scanner, etc.
  - Finish 1st Design
  - Test UI paper prototypes in laboratory
  - Implement Feedback
  - Plan Local Testing
- **May**
  - Conduct Local Testing
  - Evaluate
  - Iterate
  - Plan Field Testing
  - Find funding partners, if possible
- **June**
  - Conclude Local Testing
  - Begin Field Testing, if possible
  - Likely, using remote partners
  - Write-Up
  - Present

![Check Digit](Check_Digit.png)

http://www.cs.washington.edu/education/courses/cse490d/13wi