Development Engineering

CSEP 590 B

Remote Temperature Monitoring

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April 20, 2020

Today

- Announcements
- Martin Lukac and Terry Chern, Nexleaf
- Discussion with Martin and Terry
- Related Projects

Announcements

- Discussion Sections – Zoom – Attend one
  - Wednesday: 3:00-4:00 pm
  - Wednesday: 5:00-6:00 pm

- Homework 3, Due April 27.
  - Submit by email
  - Course grade based on 7 of 9 assignments

Course Schedule

Date	Topic	Lead
April 6	Engineering the Vaccine Cold Chain	
April 13	Community Cellular Networks	Kurtis Heimerl
April 20	Remote Temperature Monitoring	Martin Lukac, Nexleaf
April 27	Election Monitoring	James Long
May 4	Voice Based Social Networks	Aditya Vashistha
May 11	TBD	
May 18	Fintech for Rural Networks	Jenny Aker
May 26	TBD	
June 1	Open Data Kit	Waylon Brunette

Development Engineering

Technological interventions to improve human and economic conditions in low-resource settings

Technical aspects of development engineering
Context for development engineering

How is development engineering practiced in different settings and domain

Remote Monitoring

- Technology
  - Sensors + Communication + Power
- Use of data
  - Immediate action
  - Delayed action
  - Aggregate use of data
- Business case
  - Is the data sufficiently useful that someone (with money) will pay for it

DevEngr Startups

- Startup model
  - An innovative disruptive idea
  - A small dedicated team
  - A supportive ecosystem

- Many examples as Social Enterprises
- Ecosystem
  - Challenge grants from BMGF and other organizations
  - Programs such as USAID “Saving Lives at Birth”
  - Support from Philanthropists

Startups

- Dimagi : Mobile support for community health workers



- Bempu : Low cost hypothermia monitoring for babies



- Embrace: Low cost infant warmers



Today – Nexleaf Analytics

- Founded by UCLA PhD Graduates
  - Nithya Ramanathan, CEO
  - Martin Lukac, CTO
- Focus on remote monitoring at scale
- Founded as non-profit in 2009
- Strong technology development and engineering development

Over to you Martin and Terry . . .

UW Work on Remote Monitoring

- Smart Connect
  - Basic connectivity for health clinics
- Fone Astra
  - Making dumb phones less dumb
  - Making smart phones smarter

Smart Connect: What is the minimum useful connectivity. Nicaragua 2010


ESTA UNIDAD DE SALUD
BRINDA LOS SIGUIENTES
SERVICIOS

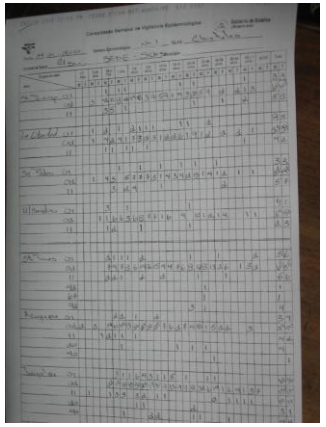
What is the minimum useful connectivity

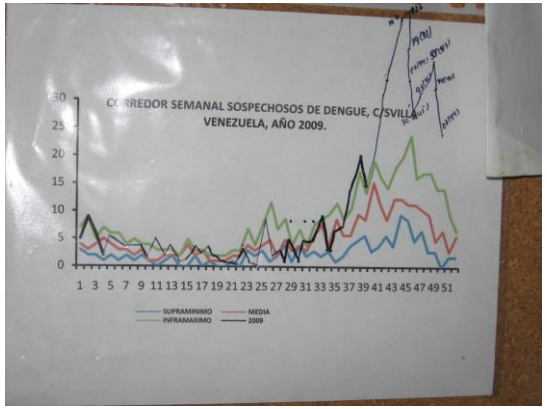
- SMS Connectivity
  - Low cost, wide reach
  - At time, 2G was the realistic option
- What are the data needs associated with peripheral clinics
- Integrate clinic communication with vaccine refrigerator
  - Refrigerator the only powered device
  - Support remote temperature monitoring

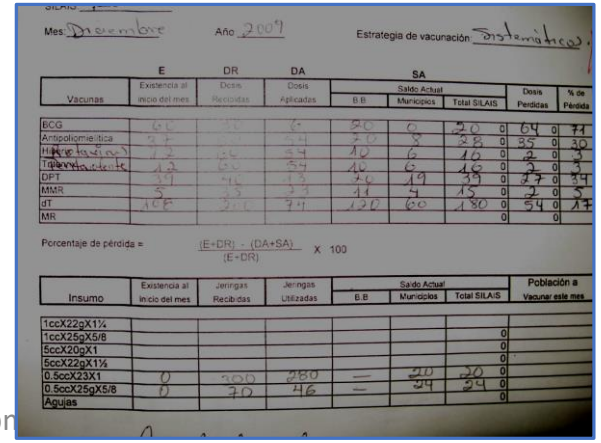
Cold Chain

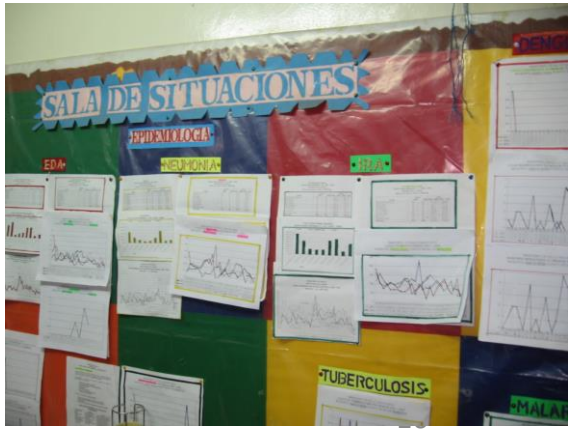
Data Needs and Use

- Reporting of diseases, immunization, cold chain
- Much of the communication done during regular visits
  - Sufficient for logistics
- Very remote facilities relied on radios, cell phones replacing radios in other areas
- Surveillance a priority from MoH
  - Wanted more frequent reporting

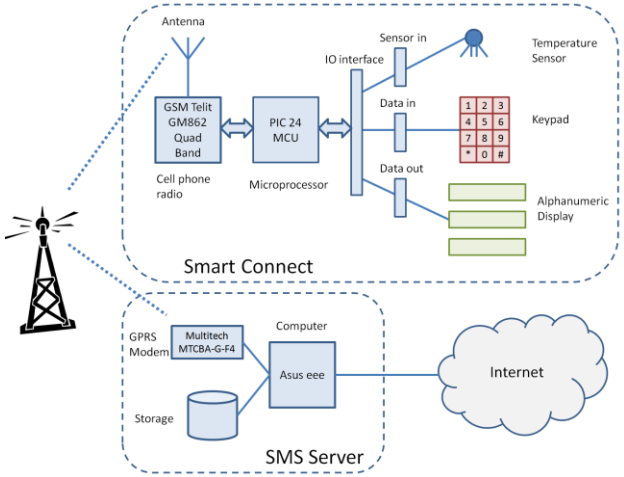


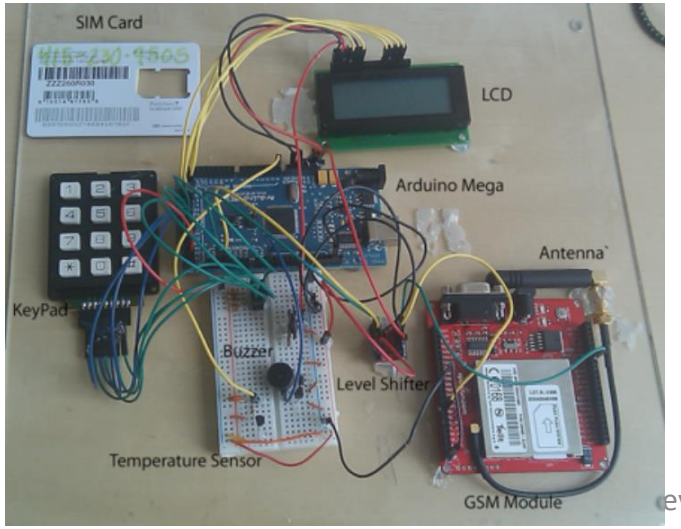


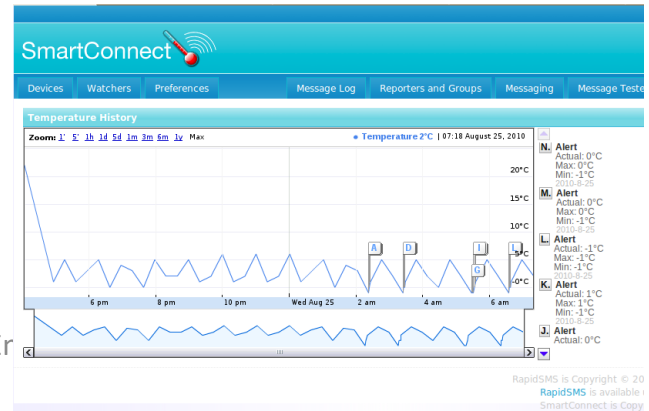




Smart Connect

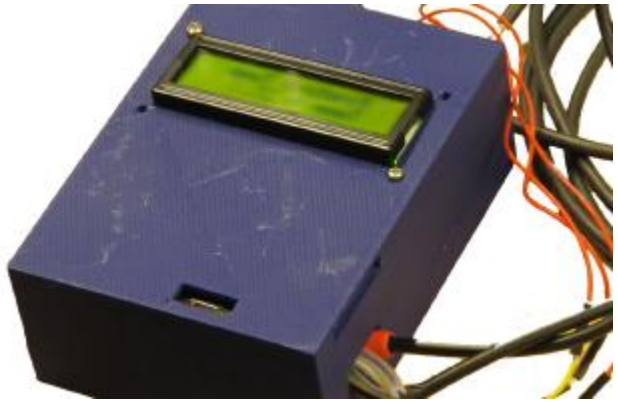


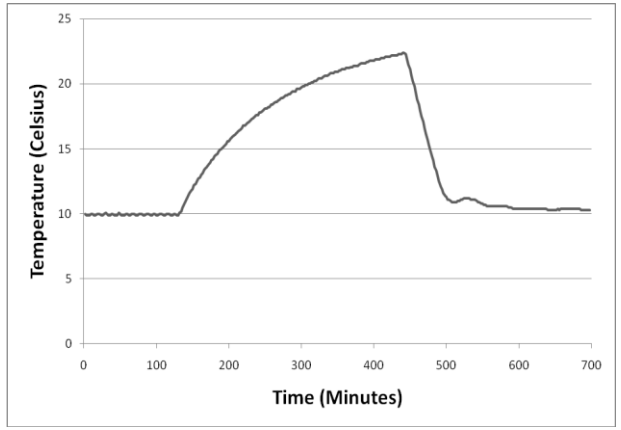




Fone Astra (Rohit Chaudhri)

- Sensor connection to low cost phone
  - Phone for communication and output
- $25 board + $25 phone
- Temperature monitoring



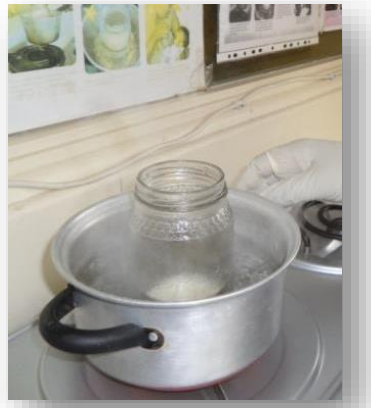


Android Fone Astra

- Version 2 of FoneAstra replaced basic phone with Android phone
- Communication by bluetooth or USB
- Separate power for FoneAstra device
- Programmability and UI on phone
- Build on ODK Sensors

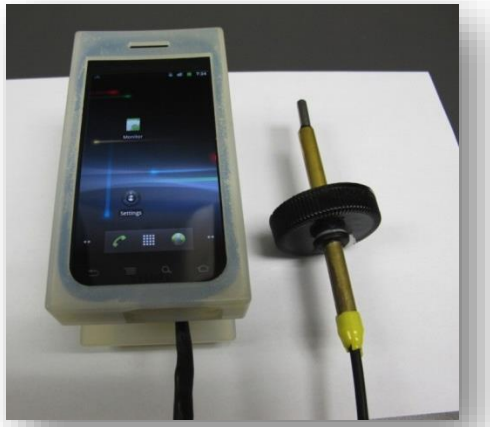
Breast milk pasteurization

- 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



Milk Pasteurization

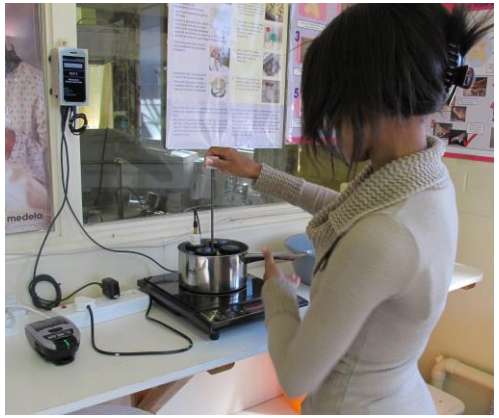
- Human milk pasteurization
- Replace high price pasteurizer with hotplate
- Temperature monitoring to ensure proper heating and verify quality

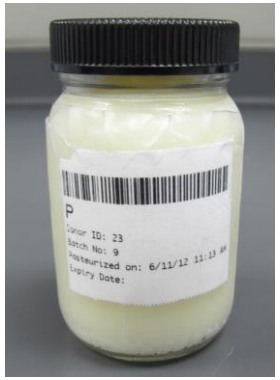


Practical, affordable breast milk pasteurization

- 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

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
  - Data use
    - Support of process
    - Quality Assurance
- Development of new interface board to support battery powered use