

# ICTD Capstone Software Design for Underserved Populations

CSE 482b

Course Overview, March 26, 2024

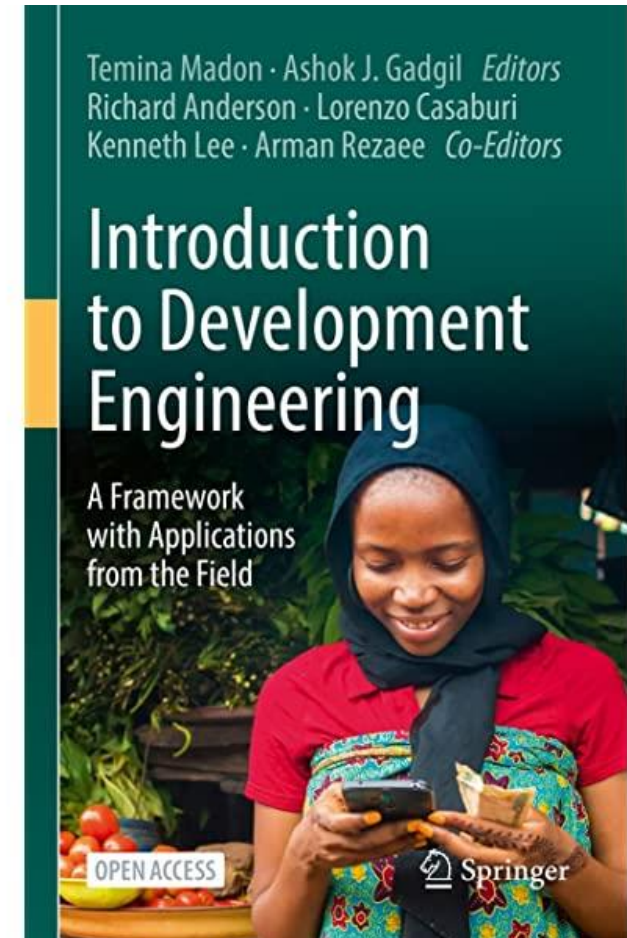
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# Today

- Capstone Courses
- Project Ideas

# Development Engineering

- Technological interventions to improve human and economic conditions in low-resource settings
- An engineering discipline aimed at addressing global inequity
- Develop principles for design, introduction, scaling, and sustainability of Global Good technology



# What are the challenges

- Domain challenges: Health, Education, Agriculture, Markets, Livelihoods, Infrastructure, Sanitation, Energy, Environmental Degradation
- Resource constraints: Finance, Infrastructure, Distance, Education and literacy, Governance
- Shocks: Climate Change, Global Pandemics

# Setting

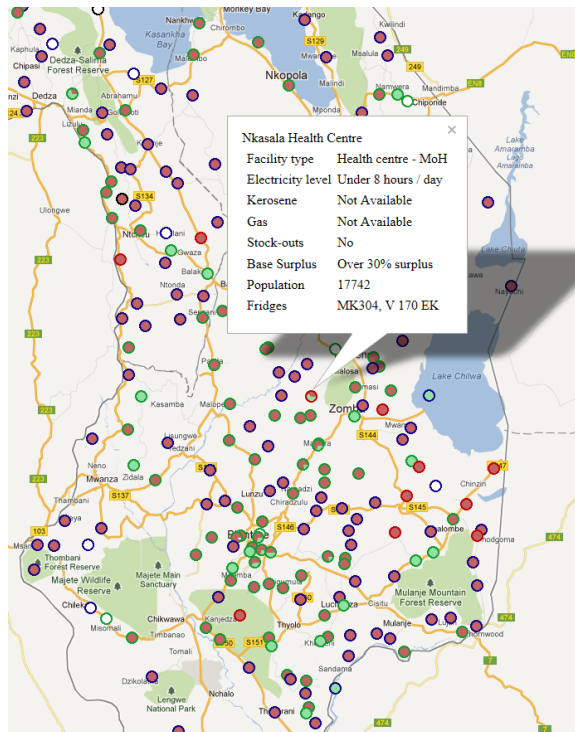
- Rapid, global economic and technological change
  - Many technologies are globally accessible
- Not just a split between “Developed” and “Developing Countries”, but within countries between “Urban-Affluent” and “Rural/Urban-Poor”
- In many ways, the world is getting better
  - Increasing literacy rates
  - Decline in maternal mortality rates
  - Near elimination of diseases such as polio

# ICTD, Information and Computing Technologies for Development

- Technology with global impact
- Appropriate for `low resource' settings
- Target development domains
  - Health, Education, Livelihood, Agriculture, Disaster Relief
- This quarter, computing and global health

# Previous ICTD Capstone Projects

## Vaccine Cold Chain Visualization System



## eKichabi Mobile Application



# CSE Capstone courses

- **Capstone Goals**

- Projects must be large enough to require teams of several students to work on over one quarter.
- Students must apply concepts from more than one sub-area of CSE (at the 300-level and above).
- The work must involve a substantial design effort.
- Students must present their work using formal oral presentations and written reports.
- Efforts must culminate in an interesting, working artifact.



# What I expect in a capstone

- Group projects
  - Four to six people per team
  - Different roles
- Design and Implementation
- Multiple check points and expert review
- Working, useful software
- Reasonable software process
- Presentation of results

# Learning goals

- Working in a team to deliver software
  - Developing a specification and solution idea
  - Choosing technologies and an architecture
  - Working in a team
- Domain expertise
  - General knowledge of problem area
  - Appropriate applications of technology
- Independent acquisition of knowledge

# The capstone challenge



- Too much stuff to fit into nine or ten weeks in the spring
- Focus on Design, Development & Implementation
- Choose at start of course from a set of project ideas

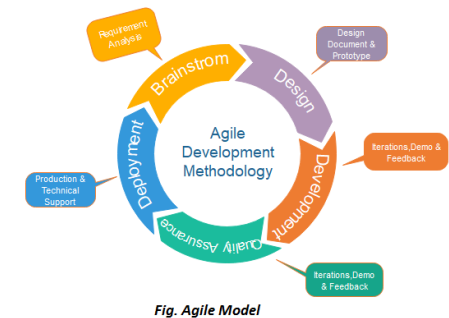
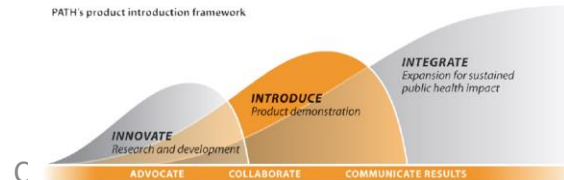
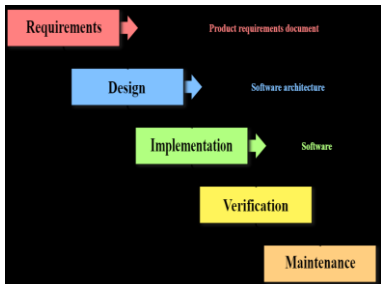


Fig. Agile Model

# Schedule

- Today (March 26) – present project ideas
- Thursday (March 28)– establish project groups
- Domain Presentation (?) :
- Domain Presentation (?) :

Schedule (Dates tentative)	
Project Pitch	Thursday, April 11
Progress Report	Thursday, April 25
Prototype Demo	Thursday, May 16
Final Presentations	Monday, June 3 2024, 10:30 am – 12:20 pm
Deliverables due: Code, Write-up	Friday, June 7, 6:00 pm

# Course Mechanics

- Group development of projects
- Lectures/class meetings for first few weeks
- Regular group meetings with course staff
- Later class sessions for presentations and demos
- Specific deliverables will be specified during the quarter
- Final turn in will include code and a paper (~10 pages)

# Domain – Global Health

- Target health care in low resource settings
- Key challenges
  - Lack of trained doctors
  - Infrastructure
  - High burden of disease
  - Finance and governance



# mHealth

- Low-cost mobile devices (smart phones and tablets) to assist health care providers
- Feasible in many settings (device availability, connectivity)
- Many different types of interventions have been developed

# Project Ideas

- Frameworks for mobile health apps
- Target contemporary mobile frameworks
- Support innovation by Health Researchers



# Projects

- ODK 1.5
- Framework for Content Apps
- Framework for Protocol Apps
- Framework for Logistics Apps
- Referral Application in Community Health Toolkit



# Open Data Kit

- Problem: Digital data collection in poorly connected environments
- 2007 Technologies:
  - Personal Digital Assistants (PDAs)
  - Feature Phones
- Forms based data collection
  - Enter data based on individual forms
  - Forms end up as records in a database
  - Example: tracking Malaria outbreak in remote villages
- Initially University of Washington project, now a widely used system under a number of different brandings



# Open Data Kit History

- Brainchild of Gaetano Borriello
- Use of Android Platform
- In 2008-2010 there was great skepticism that smart phones would be a feasible device for global work
- Initial development by UW PhD students
- Open Data Kit: Suite of tools for data collection
- Spun out from UW as independent projects





# ODK 1.5

- Re-implement ODK using a modern framework such as Flutter
  - Improved layout and design
  - Cross Platform
- Project focus
  - Express forms in Excel (CSV)
  - App on phones for collecting data WRT to forms
  - Backend service for managing collected forms

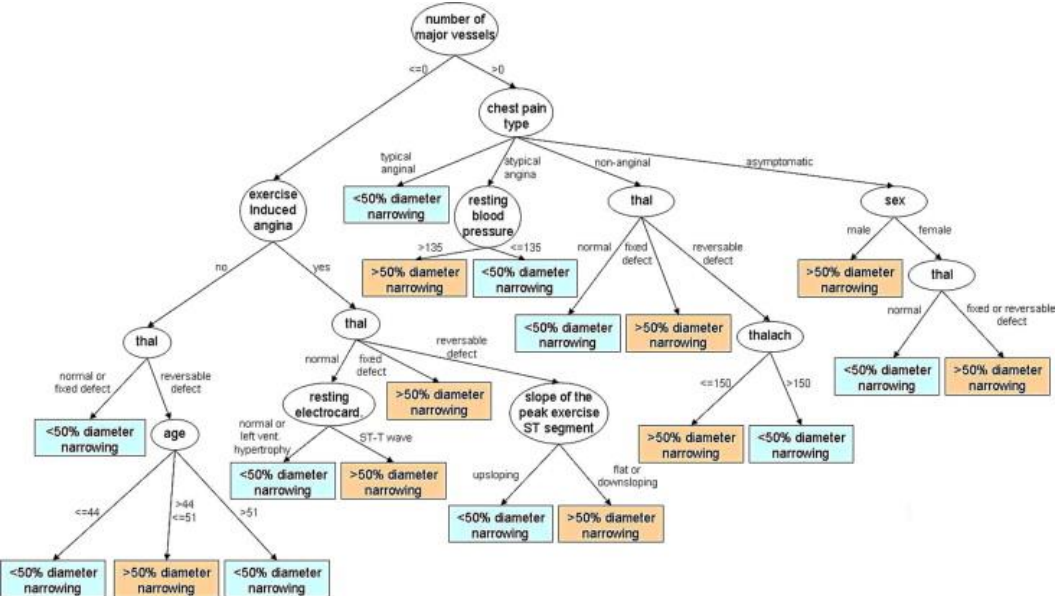
# Content App

- Applications (primarily) focusing on presentation of Multimedia Content
- Example – MARA App
  - Contraceptive information for young women in Kenya
- Need – create a framework to separate the content from the logic, so that it can be managed by health researchers and designers
- App supporting offline use, multilingual, multimedia

# Protocol App

- Health Applications stepping through a medical protocols
- IMCI Integrated Management of Childhood Illness
- Logic for clinical apps can be structured as decision trees

THEN ASK ABOUT MAIN SYMPTOMS: Does the child have cough or difficult breathing?		SIGNS	CLASSIFY AS	TREATMENT <small>(Urgent pre-referral treatments are in bold print.)</small>
<b>IF YES, ASK:</b> • For how long? • Count the breaths in one minute. • Look for chest indrawing. • Look and listen for stridor.	<b>LOOK, LISTEN, FEEL:</b> } CHILD MUST BE CALM	<b>Classify COUGH or DIFFICULT BREATHING</b>  • Any general danger sign or • Chest indrawing or • Stridor in calm child.  • Fast breathing.	SEVERE PNEUMONIA OR VERY SEVERE DISEASE	> Give first dose of an appropriate antibiotic. > Refer URGENTLY to hospital.*
			PNEUMONIA	> Give an appropriate antibiotic for 5 days. > Soothe the throat and relieve the cough with a safe remedy. > Advise mother when to return immediately. > Follow-up in 2 days.
			NO PNEUMONIA: COUGH OR COLD	> If coughing more than 30 days, refer for assessment. > Soothe the throat and relieve the cough with a safe remedy. > Advise mother when to return immediately. > Follow-up in 5 days if not improving.
<b>IF THE CHILD IS:</b> 2 months up to 12 months 12 months up to 5 years		<b>Fast breathing is:</b> 50 breaths per minute or more 40 breaths per minute or more		
		No signs of pneumonia or very severe disease.		

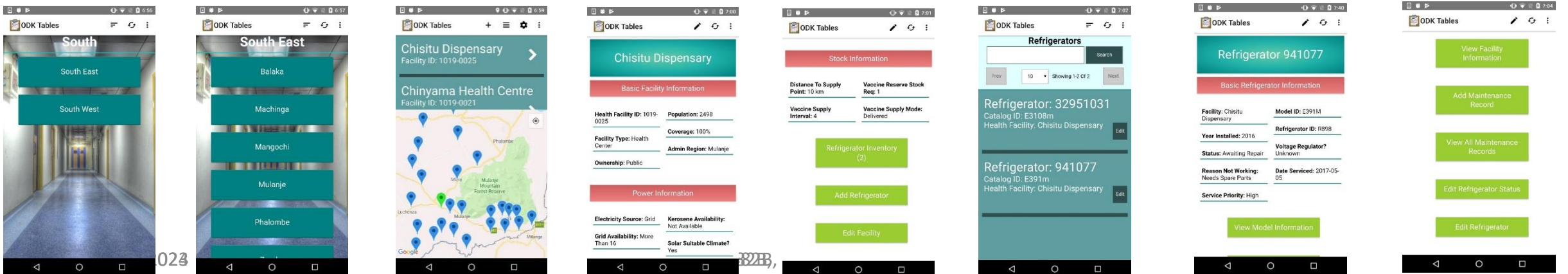


# App Compiler for Decision Trees

- Develop a system to convert a decision tree to an app
- Screens for data entry and branching based on values
- Input format should be a table
  - This is preferable to an interactive approach as these are often reviewed and modifies
- The App could be integrated with data collection devices (but outside of the scope)

# Logistics App

- Vaccine Cold Chain Project – mobile App for tracking country immunization systems
- Problem is to manage a country wide database of vaccine refrigerators
- Application developed (with UW PhD student and PATH) and deployed in Uganda





# Lessons learned

- Application needs to be online/offline, but a different synchronization model is needed
- Application needs to be simple enough to run on a variety of user owned mobile phones
- Credential management
- Express in a more general framework for a logistics management application

# Referral Application in Community Health Toolkit

- General problem of surgery follow-up and scheduling
- Need to target multiple types of messaging, including SMS
- Health care workers likely to have smart phones, but patients will likely have basic mobile phones
- Identifying cases with complications and needs for follow-up is critical
  - Transportation is expensive and time consuming

# Develop a prototype system for Post-Caesarian Follow-up for Kenya

- Project suggested by UW researcher working with doctors in Kenya
- Build on top of Community Health Toolkit
  - <https://communityhealthtoolkit.org/>