

ICTD Capstone Software Design for Underserved Populations

CSE 482b

Course Overview, January 4, 2022

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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, two themes:
 - eKichabi 2.0: prototype for yellow pages service for rural Africa
 - Global health and Covid-19

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 or five people per team
 - Different roles
- Design and Implementation
- Multiple check points and expert review
- Working, useful software
- Reasonable software process
- Presentation of results

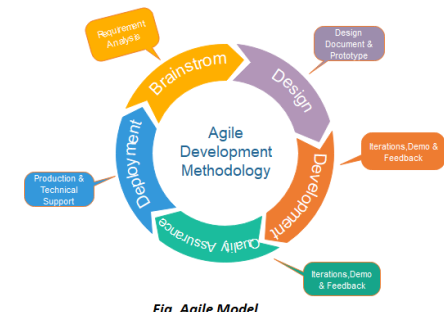
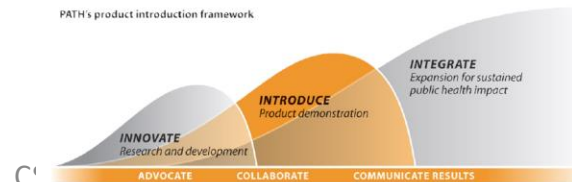
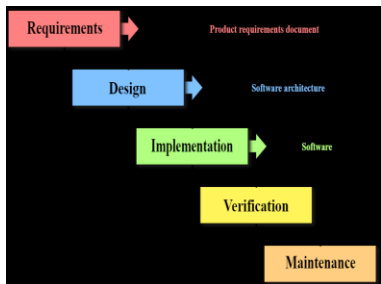
Learning goals

- 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 weeks in the spring
- Focus on Design, Development & Implementation
- Choose at start of course from a set of project ideas



Schedule

- Today (Jan 4) – present project ideas
- Thursday (Jan 6) – establish project groups
- Domain Presentation (Jan 11) : Kichabi
- Domain Presentation (Jan 13) : Covid, Immunization, Global Health

Schedule (Dates tentative)	
Project Pitch	January 18
Progress Report	February 1
Prototype Demo	February 22
Final Presentations	March 8 and March 10
Deliverables due: Code, Writeup	Friday, March 18

Course Mechanics

- Group development of projects
- Lectures/class meetings for first few weeks
 - If we are allowed to meet in person: Odegaard 136
- 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)

Project Ideas

1. eKichabi

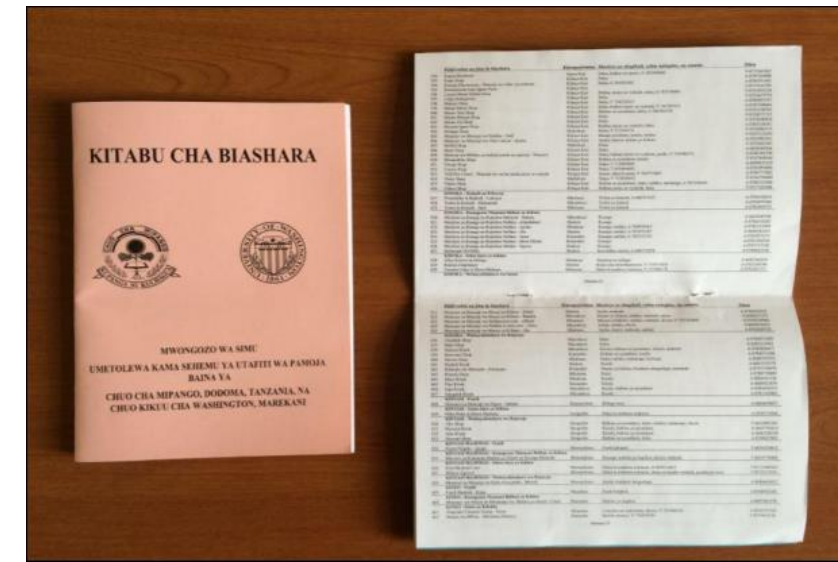
- a) Mobile customer application
- b) Business registration module
- c) Basic Phone Compatibility

2. Global Health and Covid

- a) Vaccine Campaign Planning and Management
- b) Epidemic Modeling / Vaccine Impact
- c) Epidemic Analysis Tools
- d) Global Data Integration

eKichabi

- Development economists implemented a paper phone book for a district in Tanzania
- Research question: Does information improve livelihood?
- UW CSE developed a mobile phone version of the phone book
- Technical contribution was the development of a scalable third-party USSD application
- Technology paper in CHI, evaluation paper submitted by economists



eKichabi 2.0

- Researchers from Cornell are launching a new version of the project in Tanzania
 - Rural, agricultural area, partially electrified, but with cell coverage
 - Hire a team to get business data
- Smart phones are becoming available, so it makes sense to include a smart phone version
 - Compatibility with basic phone version required
 - Android the most common mobile phone
- This project domain is to **Prototype** eKichabi 2.0
 - So it is not required to get all of the details right

eKichabi Projects

Mobile Application

Mobile client for interacting with Kichabi

Registration

Business registration module

Basic Phone Integration

USSD plus Smart Phone

If there are multiple teams, projects can be loosely integrated or independent

Global Goods Software

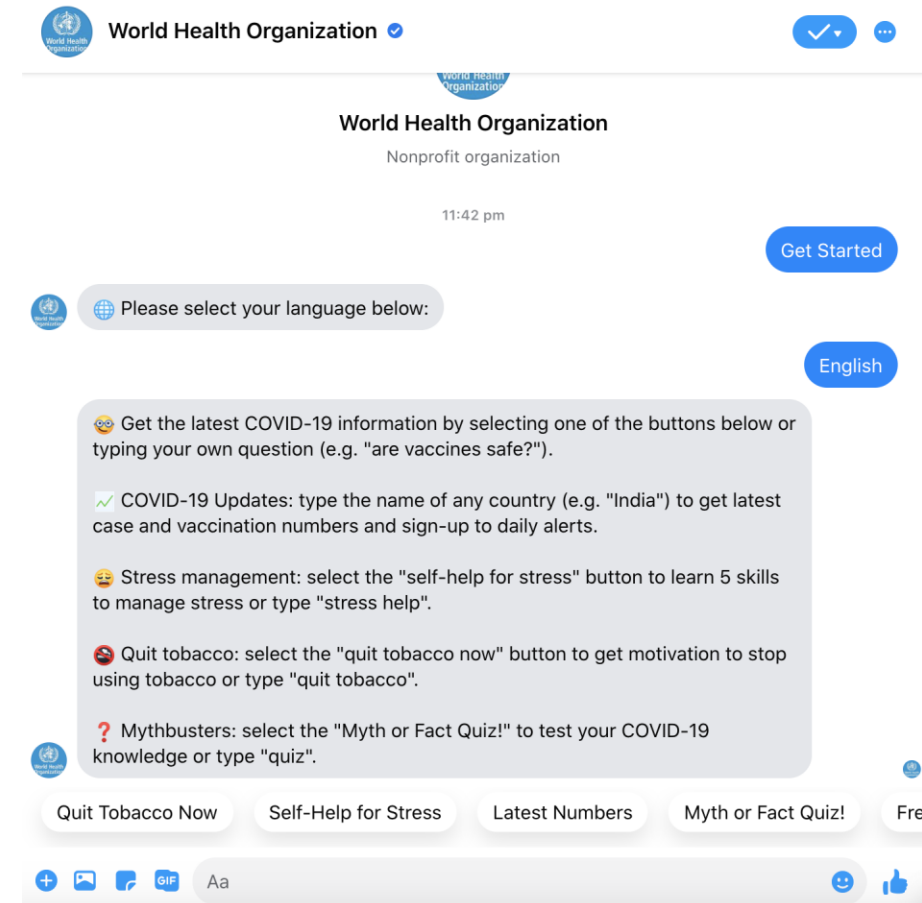


- Software systems for global development
 - Health data reporting, medical records, human resource management, health insurance, logistics
- Goal of Global Goods software is to have a positive impact
- Generally, Open Source, but different models
 - Many projects depend on donor support
- Projects often have a fairly long history
 - Barriers to entry



Informational Covid Chatbot

- Chatbots created to share information about COVID-19, address misinformation, support related health behaviors (e.g., stress management), and answer FAQs
- Define specific use cases and consider additional functionalities, such as registration/reminders for vaccines or reporting/evaluating misinformation



Vaccine Campaign Planning/Support Tool

- Countries receive shipments of vaccines (millions of doses) and need to plan campaigns to distribute and use vaccines
- Develop a system that manages the information needs for both distribution of vaccines and verification of immunization
 - The system could involve various existing tools such as DHIS2 and ODK
- Focus on system architecture and domain understanding



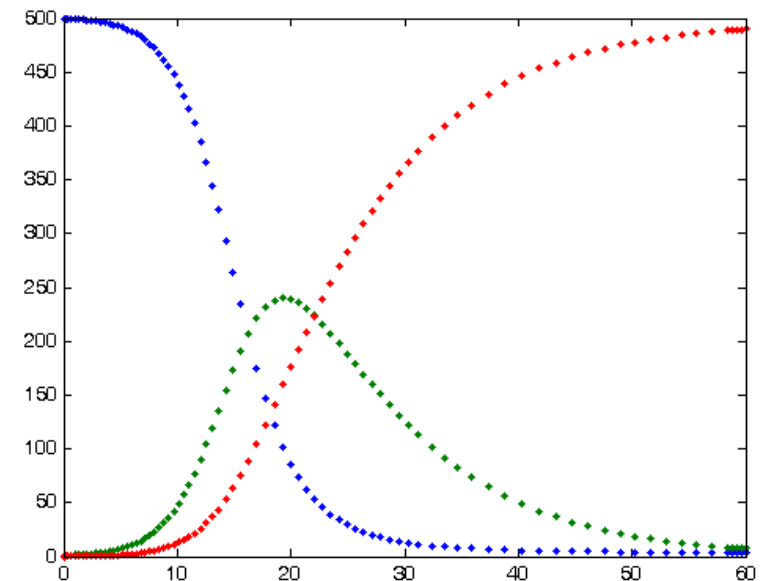
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Epidemic Modeling Tools

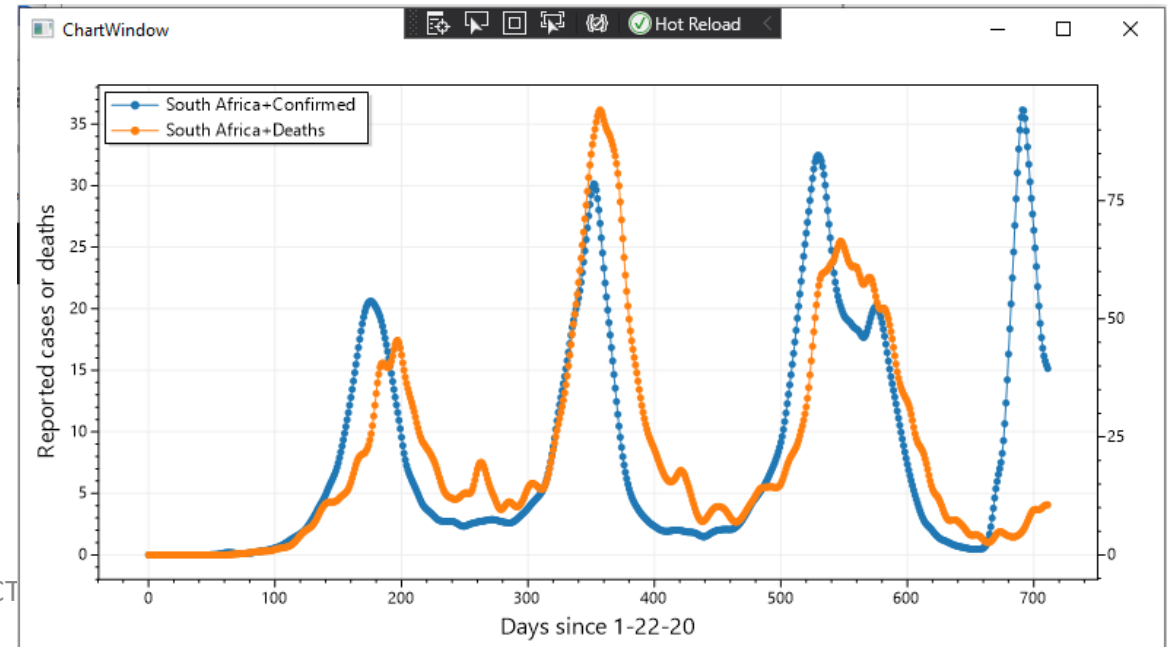
$$\begin{aligned}\frac{dS}{dt} &= -\beta \frac{SI}{N} \\ \frac{dI}{dt} &= \beta \frac{SI}{N} - \gamma I \\ \frac{dR}{dt} &= \gamma I \\ N &= S + I + R\end{aligned}$$

- Develop tools for modeling covid pandemic under different assumption
- SIR framework (Susceptible, Infected, Recovered)
- Extend models to include demographics and vaccination data
- Compare with historical data
 - Lots of data is available and ready to build on



Global disease analysis tools

- Very good data sources for covid
 - <https://ourworldindata.org/>,
 - <https://github.com/CSSEGISandData/COVID-19>
- Develop tools for exploring different aspects of global data
 - Data aggregation
 - Topic specific analysis tools
- Pick a topic area
 - Rural / urban correlations
 - Tracking waves of infection



Data Integration

- Several different global sources for covid data
- National results are aggregated, but sub-national in different sources
- Mapping at local level (counties, census tracts) makes it possible to see different trends
- General tools for data integration and map visualization would be very useful

Project List

- eKichabi 2.0

1. Mobile client for interacting with Kichabi
2. Business registration module
3. Basic Phone Integration: USSD plus Smart Phone

- Global Health / Covid-19

4. Informational Covid Chatbot
5. Vaccine Campaign Planning software support
6. Epidemic modeling tools
7. Global disease analysis tools
8. Covid data integration