Epidemiological Modeling Portal

Pandemic Processing

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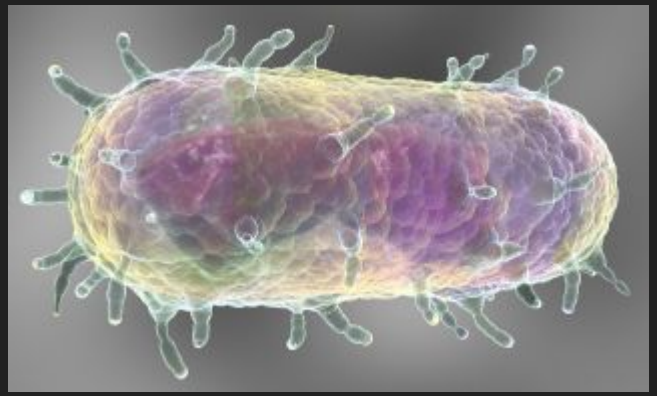
Introduction

Plagues

- Plague of Justinian in 541 and lasted 200 years.
  - 25-50 million deaths
- Black Death during 1347-1350
  - Killed ~60% of the European population



West Africa Ebola Outbreak

- Occurred December 2013 - June 2016
- 11,310 total deaths
- 4,806 of those were Liberian deaths

What is epidemiology and how does it help?

Epidemiology: The study of infectious disease and how it spreads within a population.

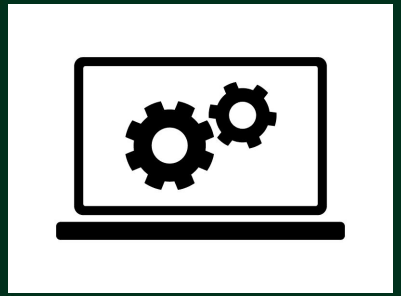
- Epidemiologists generate models to show the spread of infectious disease.
- These models can be used to predict the best time to vaccinate against infectious diseases.
- Proper timing is imperative to prevent the spread of infection.

General Workflow

Collect Data

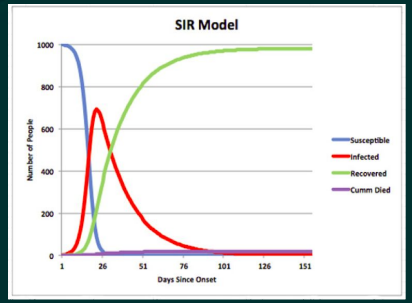
Data Sets
Researched Data

Model Data



Modeling programs:
C
R
Python

Model Implications



Build Predictions

Preventative Measures

Distribute Vaccine

Our Client

Dr. Joseph Mihaljevic:

- Assistant professor in SICCS
- Researches and collects data concerning the spread of infectious disease
- Primary focus:
  - Ecological preservation through biocontrol
  - Controlling outbreaks of infectious disease

Modeling in reality

EON: Epidemic Observation Network

EON will epidemiologists to:

- Share models with the community
- Decide how their models appear to viewers
- Interact with and provide feedback on other models
- Discuss future models without a model fully developed yet
- Edit and share the code used to generate models

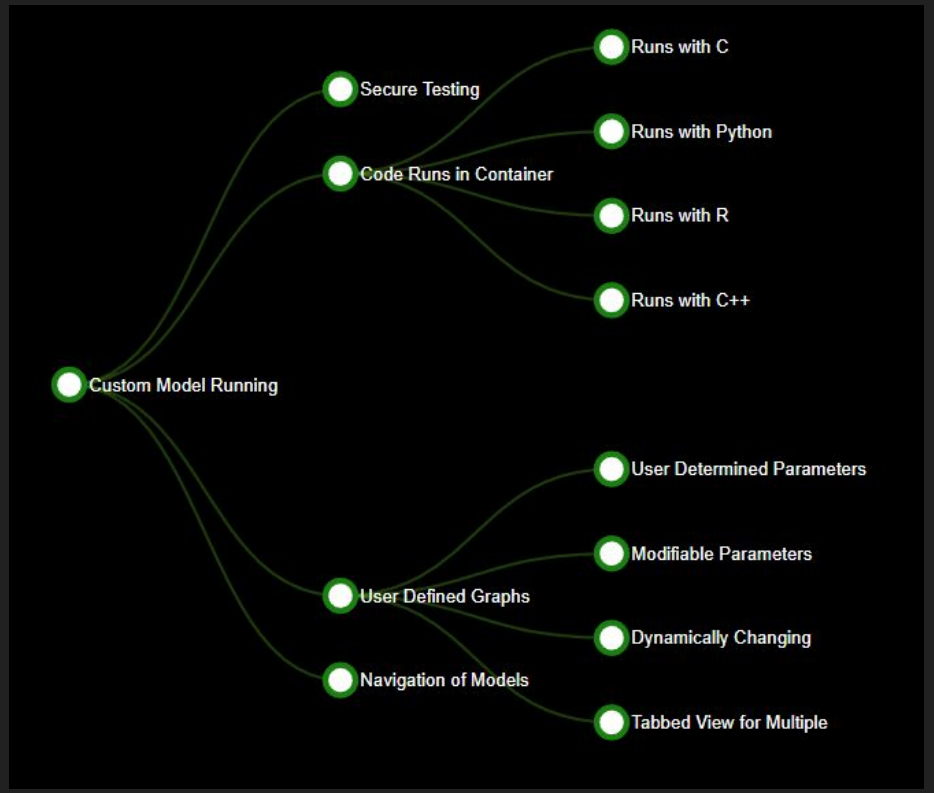
Functional Requirements

Acquired through numerous client meetings.

- User accounts and management
- Allow users to upload custom models
- Allow users to run/explore uploaded models
- Support cloning, modification, and sharing of models
- Support multiple modeling languages
- Ability to extend with new languages
- Forum for the discussion of models

Requirements Expansion Explained

- 85 functional requirements over 4 levels
- 25 performance requirements attached to these



Performance Requirements for Running Models

Running models should fall within these qualitative constraints:

- The user should be able to navigate the upload process in one minute after uploading one model.
- The model code should run within 7 seconds
- Models run with the latest version of the language used.
- Models are proven to be secure by running in a container.

Environmental Constraints

Running user generated models implies of a number on constraints that must be adhered to:

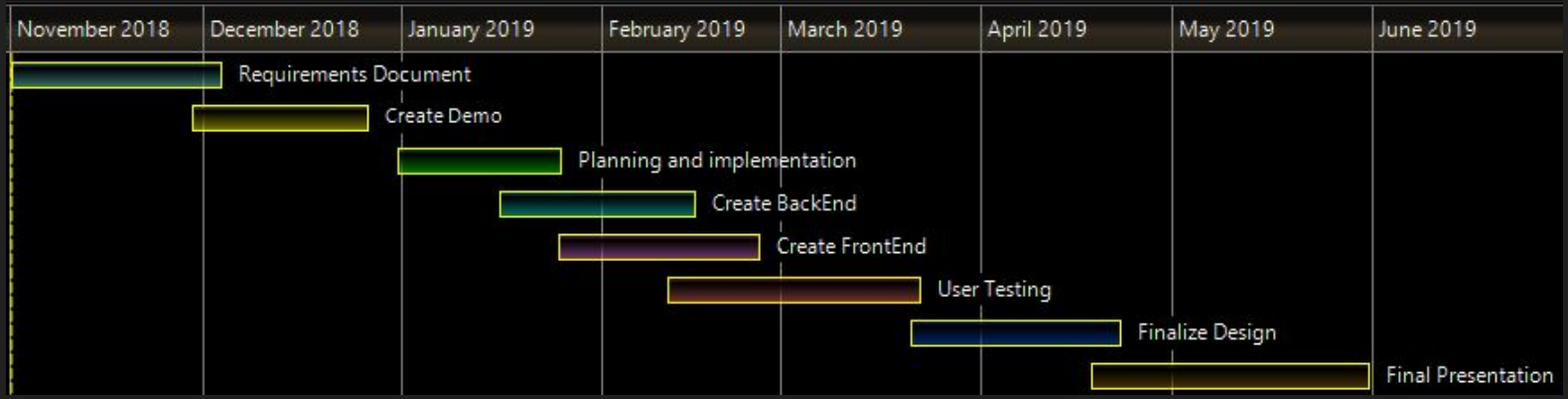
- The modelers use many languages to describe their models, including:
  - Python
  - C
  - R
- Graphs (visual model representations) are two dimensional
- Many web browsers must be supported to extend the reach of the application.

Risks/Feasibility

Risk	Severity	Likelihood
Individuals uploading/downloading malicious code	High	Low
User’s programming language not supported	Medium	Medium
Server overloaded with running models	Medium	Low
Difficult entry: New users may find the platform challenging to use	High	Medium
Users wish to maintain IP rights to code	Medium/High	Medium
Singular point of reference	High	High

Future Plans

- Start creating the technological demo
  1. Upload and run user code
  2. Create a CSV
  3. Generate an interactive graph



Conclusion

- Epidemiology is important when it comes to lessening the number of deaths due to infectious disease
- EON will speed up and optimize this process
- Thus our application will be invaluable for assisting epidemiologists in their future endeavours