

# Team Livermore

3D Simulation of Human Anatomy and  
Medical Conditions

D4: Team Final Project Presentation

Members:  
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Syed, Rafay

# Link to Video of Presentation

- [https://drive.google.com/open?id=1W\\_A9ExAJ2h300HqMVkQOfYCXfEg\\_77Mn](https://drive.google.com/open?id=1W_A9ExAJ2h300HqMVkQOfYCXfEg_77Mn)

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# Project Goals and Objectives

- Research
  - Address issues with patient understanding of medical condition after diagnosis.
  - Address issues with tool interoperability by using FHIR standard
- Functionality/Usability/Design
  - Personalized patient education.
  - Standards based patient modeling.
  - Implements the required functionality.
  - Simple to use interface, beautiful presentation.
  - Engaging educational materials.
- Innovation
  - Resource that can be launched by EMS and delivered to patients.
  - Interactive 3D presentation of liver in conjunction with educational materials.

# Project Goals and Objectives

- Research
  - Address issues with patient understanding of medical condition after diagnosis.
    - The following authors enumerate issues and their solutions around patient medical understanding:
      - Yang, et. al. - The benefit of patient in terms of outcomes (Yang, 2018)
      - Ravindranath and Brenner, et. al. - The accessibility of patient education (Ravindranath M, 2013)
      - Dreeben - The availability of patient education (Dreeben, 2010)
  - Address issues with tool interoperability by using FHIR standard
    - Needed to facilitate ease of physician providing education to patient.
      - Farahani, et. al. - The difficulty of physicians of providing education - and the need to make it easy (Farahani, 2013)
      - Mandel, et. al. - Using standards to facilitate interoperability (Mandel, 2018)

# Project Goals and Objectives

To achieve our project goals and objectives, Team Livermore completed:

- 3D modeling of 7 liver disease states using Blender
- Vetting and subsequent creation of FHIR server
- MySQL database design and creation
- Patient data, educational material creation, and database population
- WebUI design:
  - Python Flask integration
  - Three.js implementation

# Team member contributions and Project Status

Task Name	Start	End	Duration (days)	Person Assigned
Project Deliverable 0	2/7/2018	2/11/2018	4	Team
Project Deliverable 1	2/12/2018	2/25/2018	13	Team
Develop prototypes	2/26/2018	3/4/2018	6	Team
Project Deliverable 2	2/26/2018	3/11/2018	13	Team
Vet HAPI server options and backup options and choose a technology.	3/5/2018	3/12/2018	7	Marcos/Rafay
Complete docker integration with prototype and test running on different system	3/12/2018	3/19/2018	7	Cheryl
Project Deliverable 3	3/12/2018	4/1/2018	20	Team
Develop educational materials for loading into database.	3/20/2018	3/27/2018	7	Jennifer
Develop framework (a base template) for developing the curriculum elements based on one of the liver diseases	3/20/2018	3/27/2018	7	Team
Develop Docker infrastructure for creating containers.	3/20/2018	3/27/2018	7	Cheryl
Develop code for sequencing container start up.	3/28/2018	4/5/2018	8	Cheryl
Develop working application framework for one disease	3/28/2018	4/5/2018	8	Team
Develop front end web page.	3/28/2018	4/5/2018	8	Andy/Marcos/Rafay
Develop threejs and 3D model integration with web page.	3/28/2018	4/5/2018	8	Andy
Develop patient data FHIR json files for patients.	3/28/2018	4/4/2018	7	Rafay
Develop MySQL database schema	3/28/2018	3/30/2018	2	Jennifer
Develop MySQL database loading automation.	3/28/2018	4/5/2018	8	Jennifer/Cheryl
Find or develop textures for the organ 3D visualizations.	3/28/2018	4/5/2018	8	Team
Develop solution to issue with 3D models maintaining correct colors.	3/28/2018	4/5/2018	8	Andy
Develop Java connector to read FHIR data and write to db.	3/28/2018	4/4/2018	7	Marcos
Develop FHIR server data loading automation.	3/28/2018	4/4/2018	7	Cheryl
Develop flask, web page and db integration.	3/28/2018	4/5/2018	8	Jennifer/Cheryl
Project Deliverable 4	4/2/2018	4/22/2018	20	Jennifer
Project Deliverable 5	4/2/2018	4/22/2018	20	Team
Normalize all of the models to be consistent	4/5/2018	4/12/2018	7	Andy
Complete interactive tutorials for 3-5 diseases.	4/13/2018	4/20/2018	7	Team
Complete user acceptance testing.	4/21/2018	4/22/2018	1	Team
Complete presentations(s).	4/21/2018	4/22/2018	1	Team

## KEY

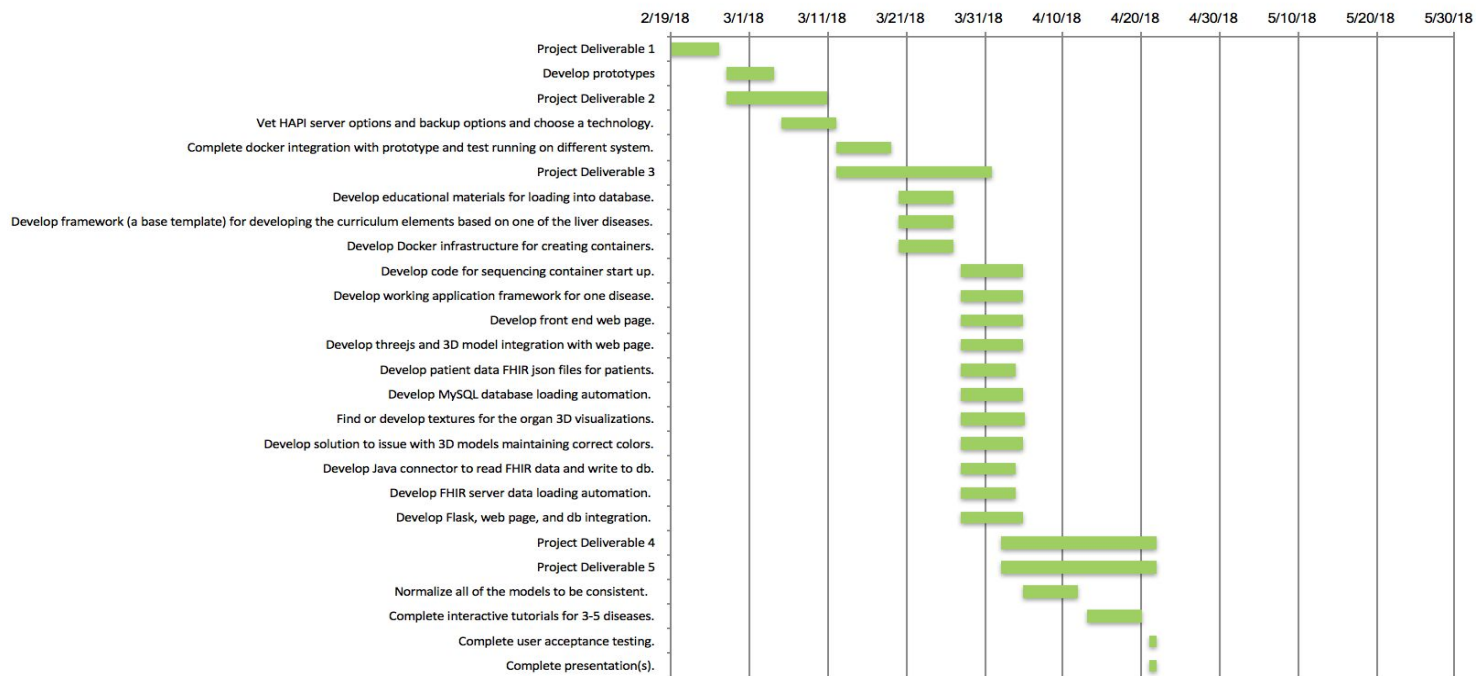
Green = Complete

Yellow = In Progress

Red = Not Started

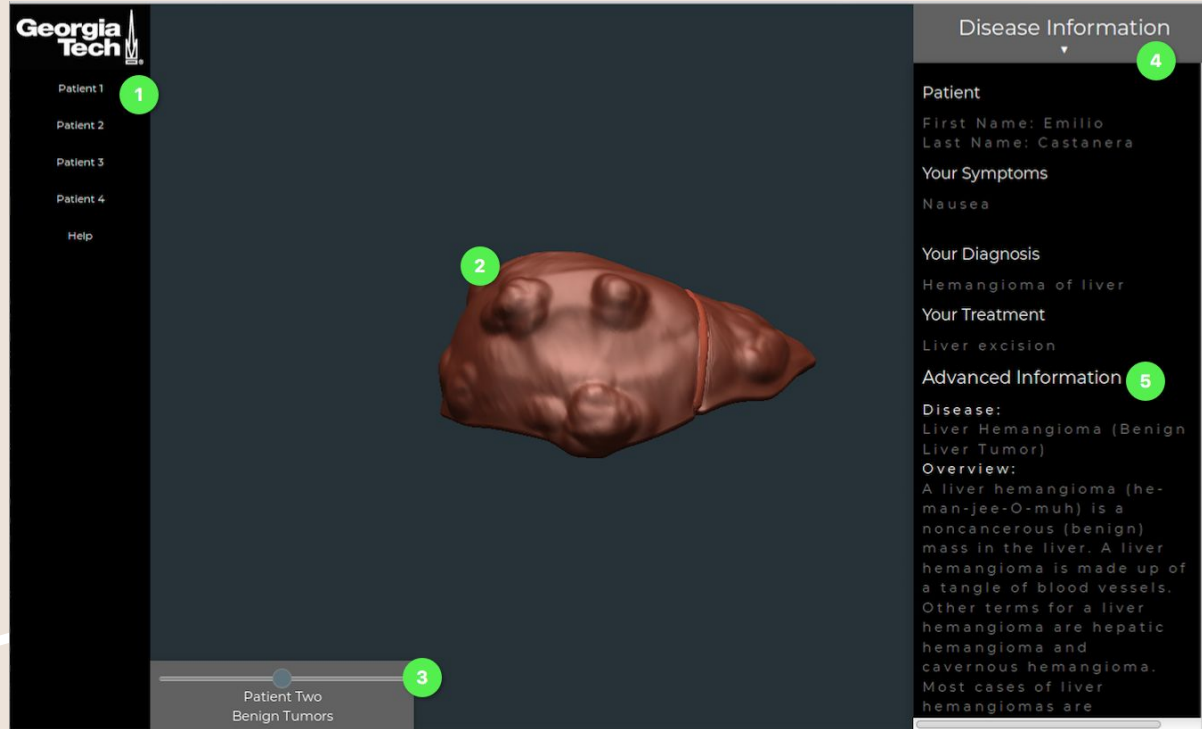
# GANTT Chart

Team Livermore Gantt Chart





# Project Successes and Unique Elements: WebUI



1 Patient navigation pane

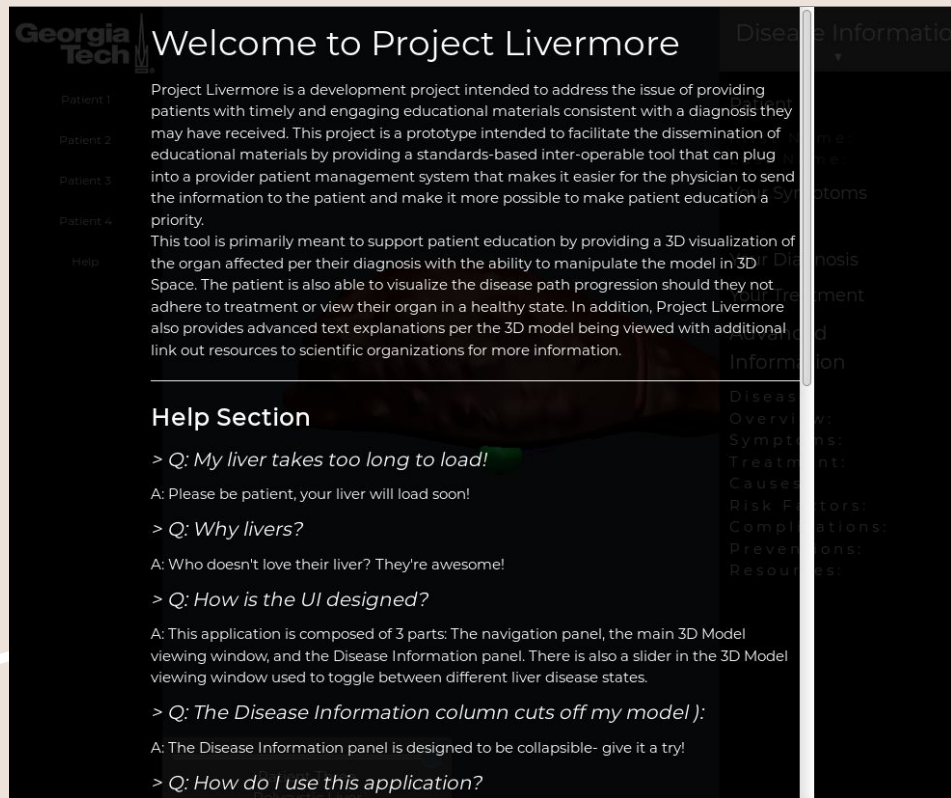
2 3D Model viewing window

3 3D Model slider

4 Disease Information

5 Advanced Information

# Project Successes and Unique Elements: WebUI – Help Page



The screenshot displays the 'Project Livermore' web interface. On the left is a dark navigation sidebar with the 'Georgia Tech' logo and links for 'Patient 1' through 'Patient 4' and 'Help'. The main content area is titled 'Welcome to Project Livermore' and contains a detailed introductory paragraph about the project's goals and a 3D visualization of the liver. Below this is a 'Help Section' with a Q&A format. The questions are: '> Q: My liver takes too long to load!', '> Q: Why livers?', '> Q: How is the UI designed?', and '> Q: The Disease Information column cuts off my model)';. The answers provide instructions on patience, UI components, and the collapsible nature of the 'Disease Information' panel. A vertical sidebar on the right, titled 'Disease Information', is partially visible and lists topics like Overview, Symptoms, Treatment, Causes, Risk Factors, Complications, and Prevention.

**Georgia Tech** Welcome to Project Livermore

Project Livermore is a development project intended to address the issue of providing patients with timely and engaging educational materials consistent with a diagnosis they may have received. This project is a prototype intended to facilitate the dissemination of educational materials by providing a standards-based inter-operable tool that can plug into a provider patient management system that makes it easier for the physician to send the information to the patient and make it more possible to make patient education a priority.

This tool is primarily meant to support patient education by providing a 3D visualization of the organ affected per their diagnosis with the ability to manipulate the model in 3D Space. The patient is also able to visualize the disease path progression should they not adhere to treatment or view their organ in a healthy state. In addition, Project Livermore also provides advanced text explanations per the 3D model being viewed with additional link out resources to scientific organizations for more information.

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## Help Section

> Q: *My liver takes too long to load!*

A: Please be patient, your liver will load soon!

> Q: *Why livers?*

A: Who doesn't love their liver? They're awesome!

> Q: *How is the UI designed?*

A: This application is composed of 3 parts: The navigation panel, the main 3D Model viewing window, and the Disease Information panel. There is also a slider in the 3D Model viewing window used to toggle between different liver disease states.

> Q: *The Disease Information column cuts off my model ):*

A: The Disease Information panel is designed to be collapsible- give it a try!

> Q: *How do I use this application?*

Disease Information

- Overview
- Symptoms
- Treatment
- Causes
- Risk Factors
- Complications
- Prevention
- Resources

# Project Successes and Unique Elements: MySQL Database

Table: PatientID

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Id (PK)  
Patient\_Id(PK)

Table: Patient

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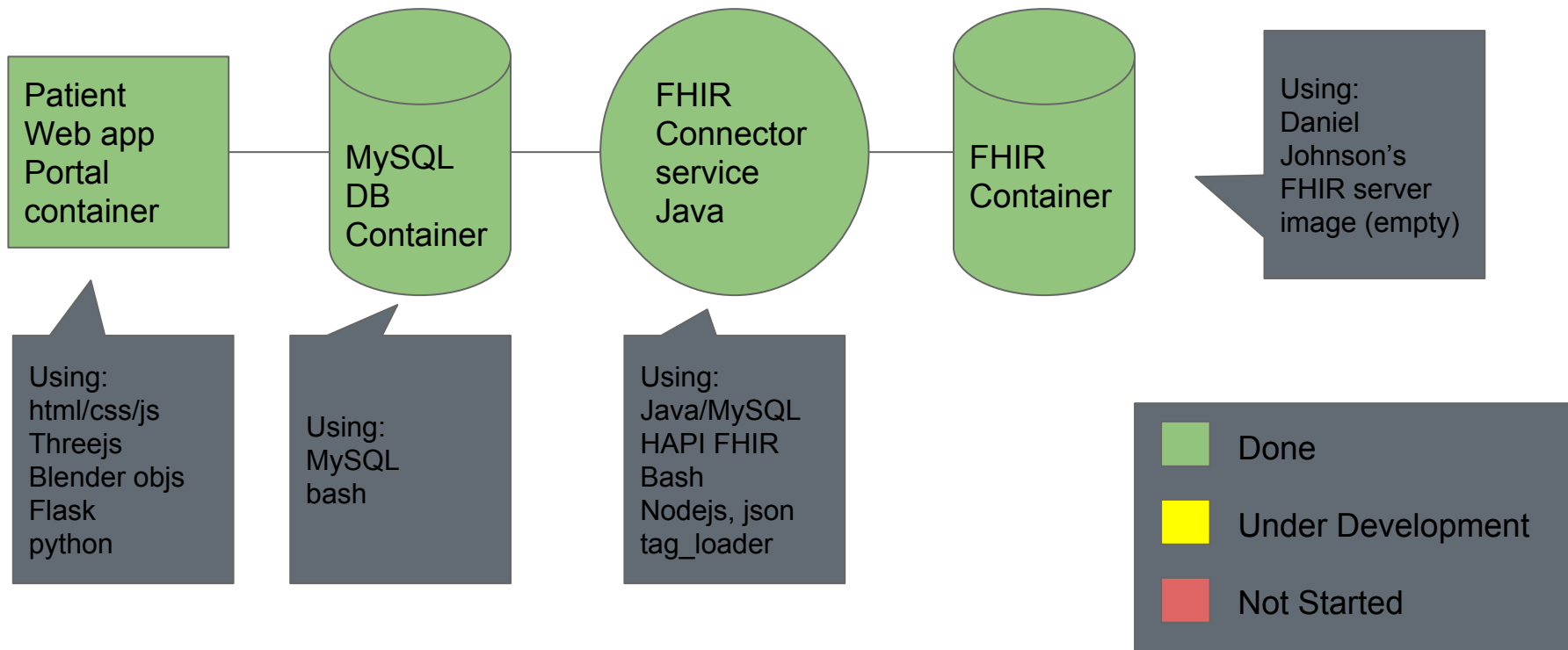
Id(PK)  
Patient\_Id(PK)  
Patient\_first\_name  
Patient\_last\_name  
Patient\_snomed\_code  
Patient\_diagnosis  
Patient\_symptoms  
Patient\_treatment

Table: Disease

---

Id(PK)  
Patient\_snomed\_code(PK)  
Disease\_name  
Disease\_overview  
Disease\_symptoms  
Disease\_treatment  
Disease\_risk\_factors  
Disease\_complications  
Disease\_preventions  
Disease\_resources

# Architecture



# Issues Addressed by the Application

- Address issues with patient understanding of medical condition after diagnosis.
  - The benefit of patient in terms of outcomes
    - ⇒ Patient receives review of diagnosis and treatment plan.
  - The accessibility of patient education
    - ⇒ Patient can access information any time.
  - The availability of patient education
    - ⇒ Patient provided personalized educational information.
- Address issues with tool interoperability by using FHIR standard
  - Needed to facilitate ease of physician providing education to patient.
    - The difficulty of physicians of providing education - and the need to make it easy
      - ⇒ Physician EMS may launch application
    - Using standards to facilitate interoperability
      - ⇒ Physician EMS may use FHIR and CDS hooks to share information with patient

# Project Future Plans and Opportunities

- Many more organs and diseases to model!
- Ability to hook up directly to an EHR service as an application that can be rendered on hand at doctor appointments.
  - CDS Hooks
- Additional technology integrations
- General application improvements
  - Performance enhancements, beautification, etc.
- General education improvements
  - Quizzes, labeling, etc.

# References

- Brenner, D., Buckley, B., DeBoer, G., Grillo-Hill, A., Owens, N. (2016). SimScientists Human Body Systems: Using Simulations to Foster Integrated Understanding of Complex, Dynamic, Interactive Systems. Retrieved, February 11, 2018 from <http://cadrek12.org/projects/simscientists-human-body-systems-using-simulations-foster-integrated-understanding-complex->
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- Farahani, M., Mohammadi, E., Mohammadi, N. (2013). Factors influencing the patient education: A qualitative research. Retrieved February 11, 2018 from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3748569/>
- Freda, M. C. (2004). Issues in Patient Education. Retrieved February 24, 2018, from [https://www.medscape.com/viewarticle/478283\\_1](https://www.medscape.com/viewarticle/478283_1)
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