Project Sprint #2

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1 PROJECT SUMMARY

In healthcare, patient portals are considered one of the most important platforms to deliver patient-centered care. In general, a patient portal provides healthcare information such as problem lists, after-visit summaries, medications, lab results as well as insurance information [1]. Despite the availability of abundant health data, most of the currently adopted patient portals suffer from information overflow and lack of interpretable visualizations, which makes it difficult for the patients to navigate through and may lead to the feeling of disconnect from the providers [1, 2]. For example, Epic MyChart displays lab results as a table with the patient's values and the standard ranges, which requires manual comparison line-by-line to find out the abnormality. Therefore, our project aims to create a patient-friendly dashboard that displays basic patient information and several additional functionalities that could potentially be added to the existing portals to help connect patient experience.

The proposed functionalities mainly include 1) a "test results" section that translates lab results into understandable diagrams that allow patients to capture the abnormally at first glance and 2) a "suggested exam" section that lists the recommended tests (e.g., breast cancer screening) based on a patient's biological sex and age. Furthermore, our team plans to optimize the display methods of other health information, including upcoming visits, past visits, new messages, and medications. Overall, our goal is to develop a compact and easily-interpretable dashboard that provides the most relevant health information for patients within one scroll.

2 TOOLS AND TECHNOLOGY

The application consists of two architectural components: backend service including data processing and front-end visualization. The following tool and technology details out what programming languages, tools, framework and libraries are planned to be utilized for each architectural component:

Backend Service:

- The primary language is python
- Flask, a python web application framework will be adopted

- MySQL will be used as the database
- RESTful APIs will be created based on the Flask framework
- Data preprocessing and wrangling

Front-end Service

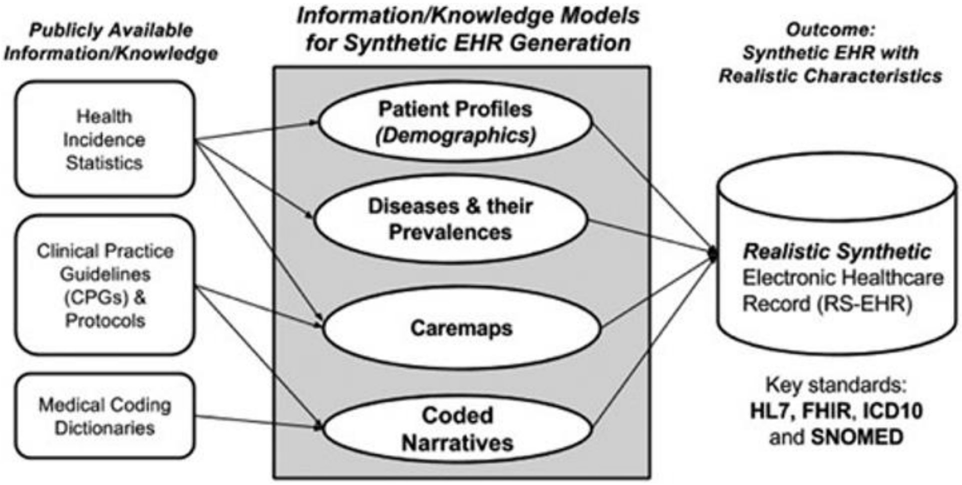
- The primary tools for front-end are HTML, CSS and JavaScript
- We might consider adopting Streamlit as the visualization tool. Additional visualization tools include plotly, Dash, Bokeh
- Several front-end libraries are under discussion for potential adoption: Angular and React.

Additional tools:

> Because the purpose of the project is to improve connectivity of patient portals with patients, we plan to integrate FHIR in our application directly by retrieving and manipulating basic elements of healthcare like patients, admissions, diagnostic reports and medications via their own resource URLs.

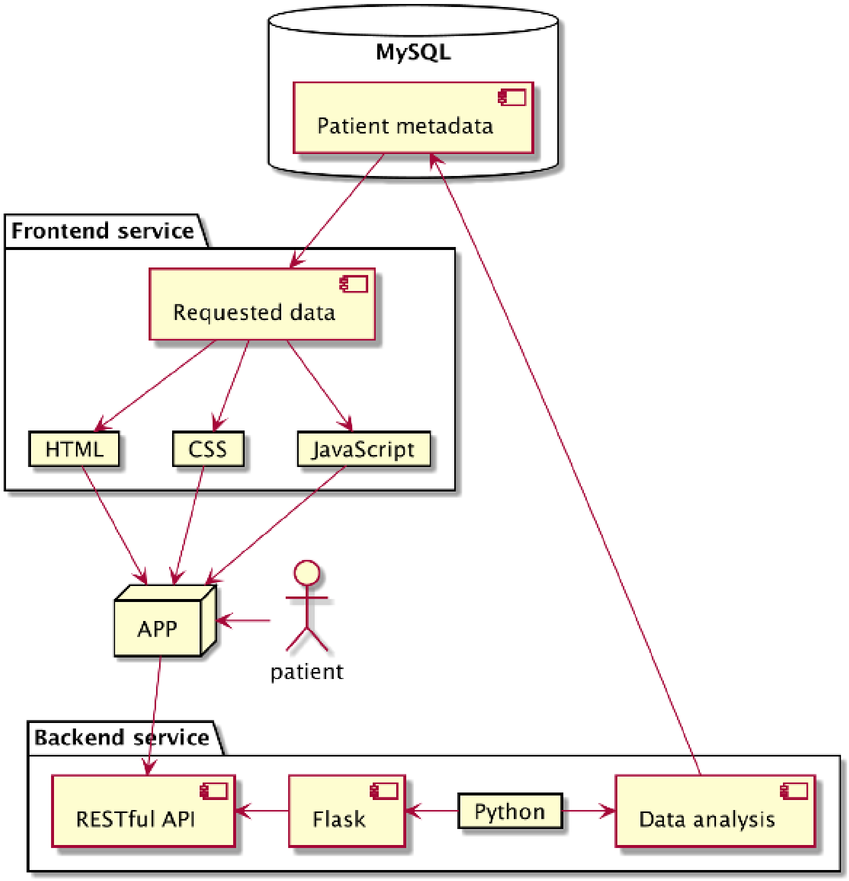
3 DATA SOURCES

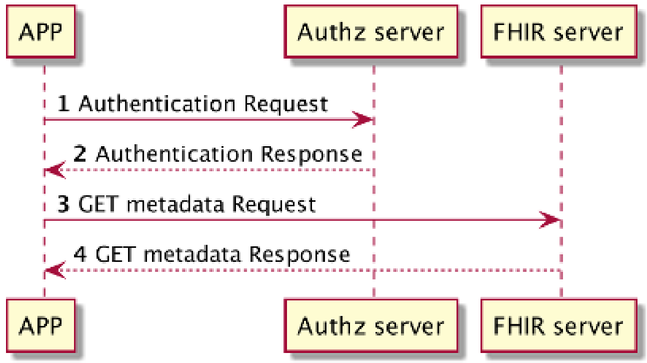
In this project, we use Synthea (https://github.com/synthetichealth/synthea) to generate patient data that are in HL7 FHIR format and export them in bulk as ndjson files. Synthea is an open-source, synthetic patient generator that emphasizes on using publicly available health statistics. It provides synthetic realistic patient data and associated health records covering every aspect of healthcare, which can be used without concern for legal or privacy restrictions. The data export includes demographics (e.g., age and gender), conditions, allergies, medications, vaccinations, observations/vitals, labs, procedures, and care plans, which will be mapped to tables in MySQL database.


Publicly Available Information/Knowledge
Health Incidence Statistics
Clinical Practice Guidelines (CPGs) & Protocols
Medical Coding Dictionaries
Information/Knowledge Models for Synthetic EHR Generation
Patient Profiles (Demographics)
Diseases & their Prevalences
Caremaps
Coded Narratives
Outcome: Synthetic EHR with Realistic Characteristics
Realistic Synthetic Electronic Healthcare Record (RS-EHR)
Key standards: HL7, FHIR, ICD10 and SNOMED

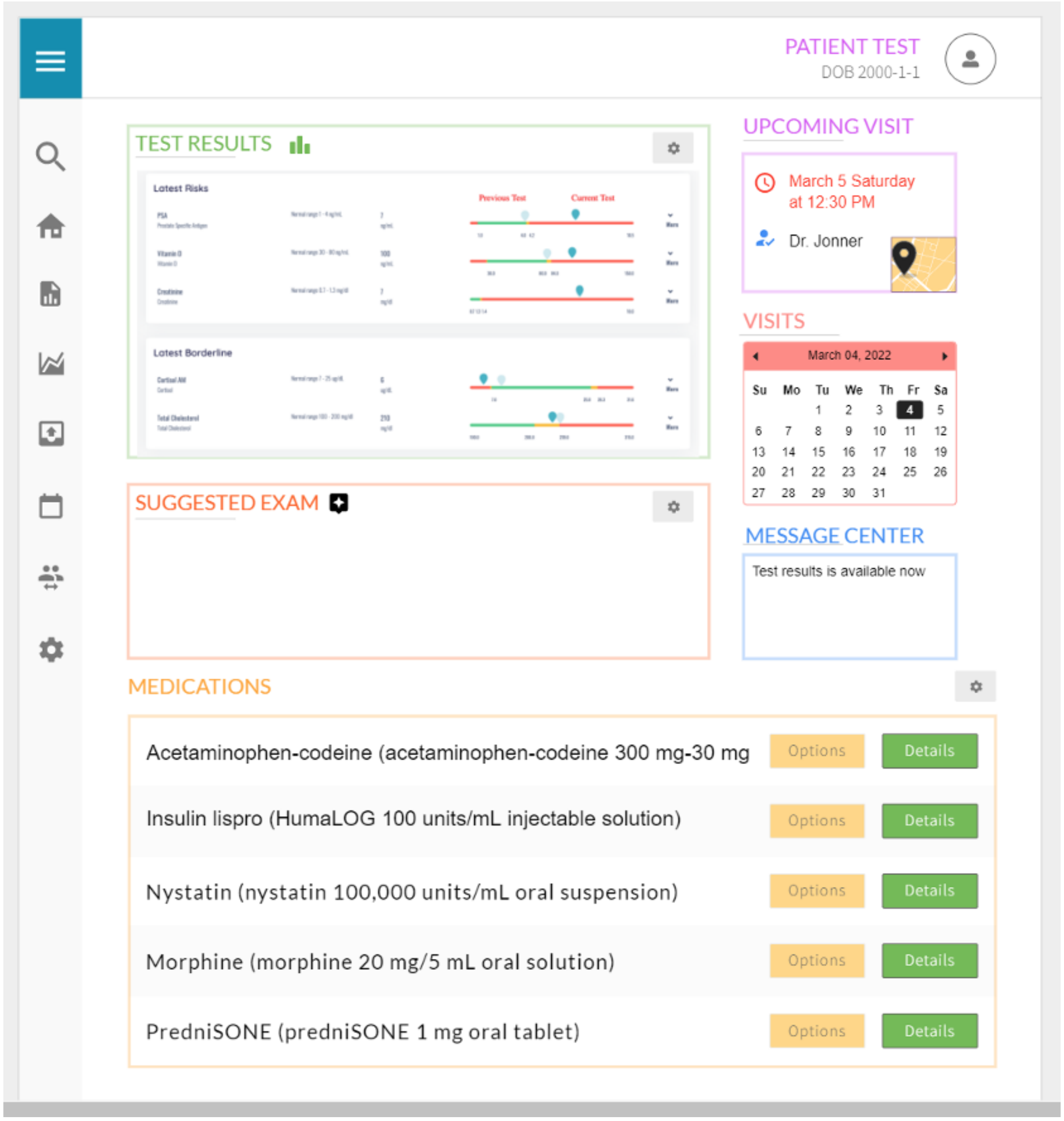
[3]

4 DIAGRAMS


MySQL
Patient metadata
Frontend service
Requested data
HTML
CSS
JavaScript
APP
patient
Backend service
RESTful API
Flask
Python
Data analysis



5 SCREEN MOCK-UP


PATIENT TEST
DOB 2000-1-1

TEST RESULTS

Latest Risks

Previous Test
Current Test

PSA
Prostate Specific Antigen
Normal range 1 - 4 ng/mL
7
ng/mL
More

Vitamin D
Vitamin D
Normal range 30 - 80 ng/mL
100
ng/mL
More

Creatinine
Creatinine
Normal range 0.7 - 1.3 mg/dl
7
mg/dl
More

Latest Borderline

Cortisol AM
Cortisol
Normal range 7 - 25 ug/dL
6
ug/dL
More

Total Cholesterol
Total Cholesterol
Normal range 100 - 200 mg/dl
210
mg/dl
More

SUGGESTED EXAM

UPCOMING VISIT

March 5 Saturday
at 12:30 PM

Dr. Jonner

VISITS

March 04, 2022

Su	Mo	Tu	We	Th	Fr	Sa
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

MESSAGE CENTER

Test results is available now

MEDICATIONS

Acetaminophen-codeine (acetaminophen-codeine 300 mg-30 mg	Options	Details
Insulin lispro (HumaLOG 100 units/mL injectable solution)	Options	Details
Nystatin (nystatin 100,000 units/mL oral suspension)	Options	Details
Morphine (morphine 20 mg/5 mL oral solution)	Options	Details
PredniSONE (predniSONE 1 mg oral tablet)	Options	Details

6 REFERENCE

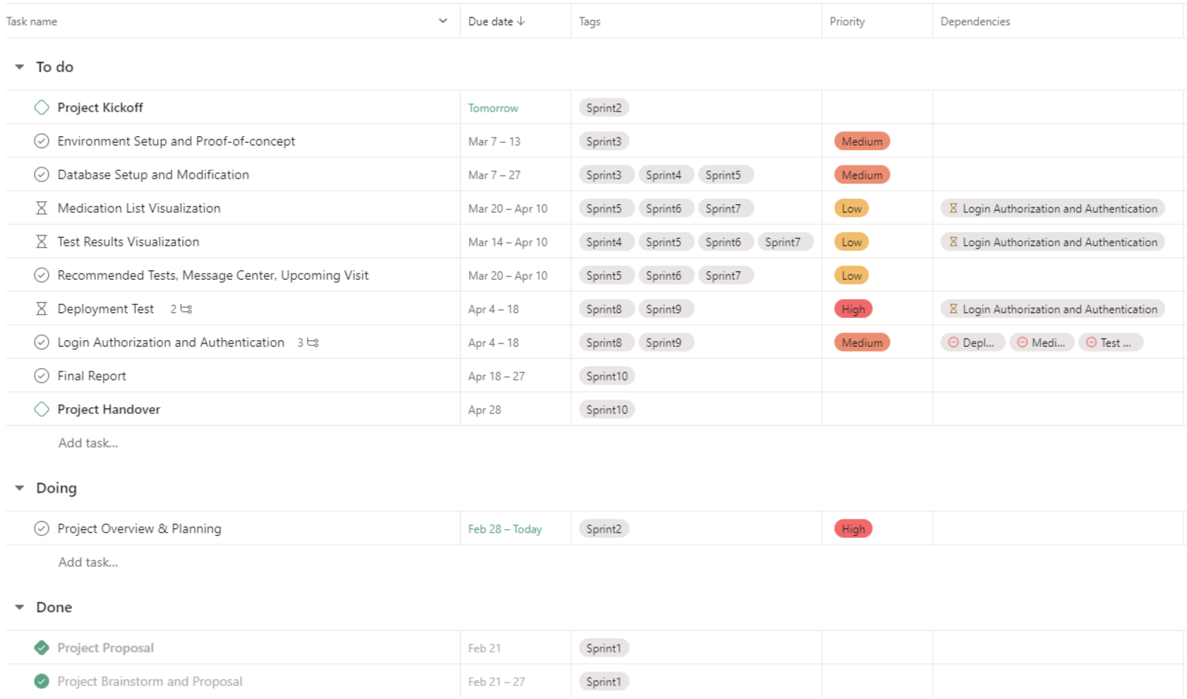
[1] Tsai, R., Bell, E. J., Woo, H., Baldwin, K., & Pfeffer, M. A. (2019). How Patients Use a Patient Portal: An Institutional Case Study of Demographics and Usage Patterns. Applied Clinical Informatics, 10(1), 96–102. https://doi.org/10.1055/s-0038-1677528

[2] Turchioe, M. R., Myers, A., Isaac, S., Baik, D., Grossman, L. V., Ancker, J. S., & Creber, R. M. (2019). A Systematic Review of Patient-Facing Visualizations of Personal Health Data. Applied Clinical Informatics, 10(4), 751–770. https://doi.org/10.1055/s-0039-1697592

[3] Synthea: An approach, method, and software mechanism for generating synthetic patients and the synthetic electronic health care record | Journal of the American Medical Informatics Association | Oxford Academic. (n.d.). Retrieved March 6, 2022, from https://academic.oup.com/jamia/article/25/3/230/4098271?login=true

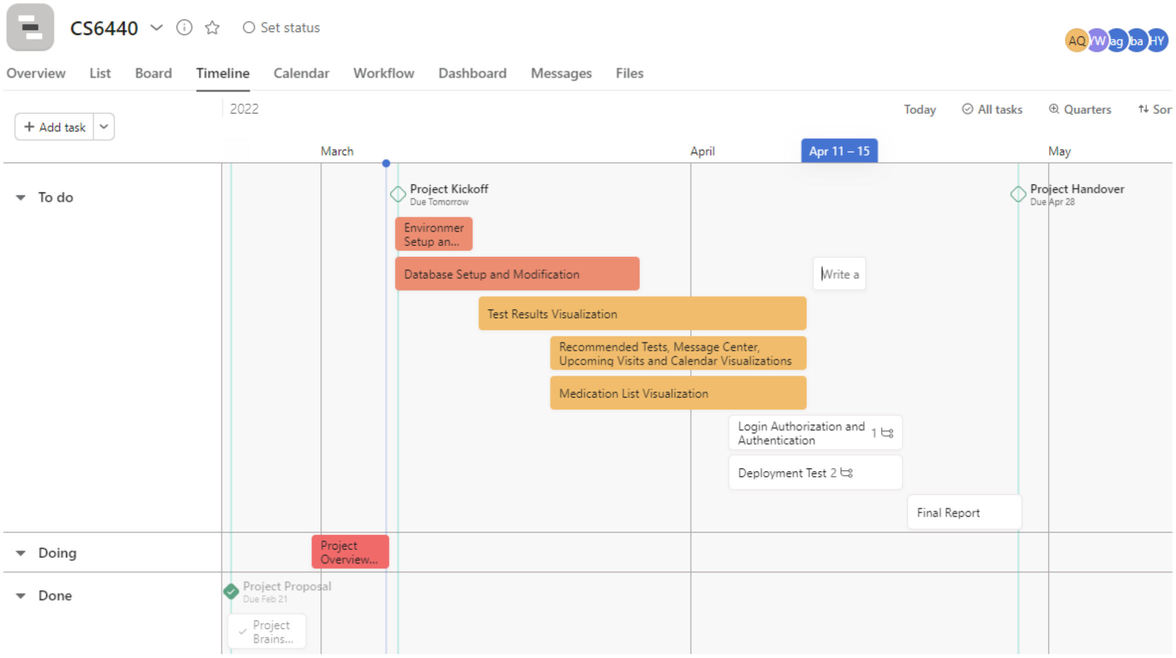
7 IMPLEMENTATION PLAN

7.1 Project tasks



Task name	Due date ↓	Tags	Priority	Dependencies
To do				
◇ Project Kickoff	Tomorrow	Sprint2		
✓ Environment Setup and Proof-of-concept	Mar 7 – 13	Sprint3	Medium	
✓ Database Setup and Modification	Mar 7 – 27	Sprint3 Sprint4 Sprint5	Medium	
⧗ Medication List Visualization	Mar 20 – Apr 10	Sprint5 Sprint6 Sprint7	Low	⧗ Login Authorization and Authentication
⧗ Test Results Visualization	Mar 14 – Apr 10	Sprint4 Sprint5 Sprint6 Sprint7	Low	⧗ Login Authorization and Authentication
✓ Recommended Tests, Message Center, Upcoming Visit	Mar 20 – Apr 10	Sprint5 Sprint6 Sprint7	Low	
⧗ Deployment Test 2	Apr 4 – 18	Sprint8 Sprint9	High	⧗ Login Authorization and Authentication
✓ Login Authorization and Authentication 3	Apr 4 – 18	Sprint8 Sprint9	Medium	⊖ Depl... ⊖ Medi... ⊖ Test ...
✓ Final Report	Apr 18 – 27	Sprint10		
◇ Project Handover	Apr 28	Sprint10		
Add task...				
Doing				
✓ Project Overview & Planning	Feb 28 – Today	Sprint2	High	
Add task...				
Done				
✓ Project Proposal	Feb 21	Sprint1		
✓ Project Brainstorm and Proposal	Feb 21 – 27	Sprint1		

7.2 Project timeline



7.3 Needs/ Risks

The primary risk of the project is to integrate various tools into the application and make it functional. Though our goal is to develop an innovative product that improves patient experience, the implementation of project modules and integrations with services sometimes turns out to be more difficult than expected, especially when we use multiple technologies and libraries. Therefore, we plan to take a conservative approach by developing a minimally functional application first and then developing those nice-to-have features. We are also concerned with technical debt. To address this risk, we plan to conduct code reviews, have in-depth testing, comply with coding standards and guidelines and appoint one member of the team to monitor the quality of the project and take ownership to all stakeholders for the success and failures.

The secondary risk of the project is scope variations. Scope variation creates a severe risk. When a scope varies, it significantly impacts the ability of the developer to stick to the original timeline of a project. Based on the assessment of the risk, we plan to do the following: 1) plan manageable iterations that allow for more opportunities to test the application and reflect upon the process. 2) elaborate on prioritized work.

Another potential risk of the project is lack of end-user engagement. Due to the fact that the goal is to improve connectivity between patient portal and patients, it is best to get user feedback during development. Because of the small scope of the project, we may not be able to look for an end-user base and collect feedback. The mitigation strategy we think of is to engage TA as an end user as much as possible.