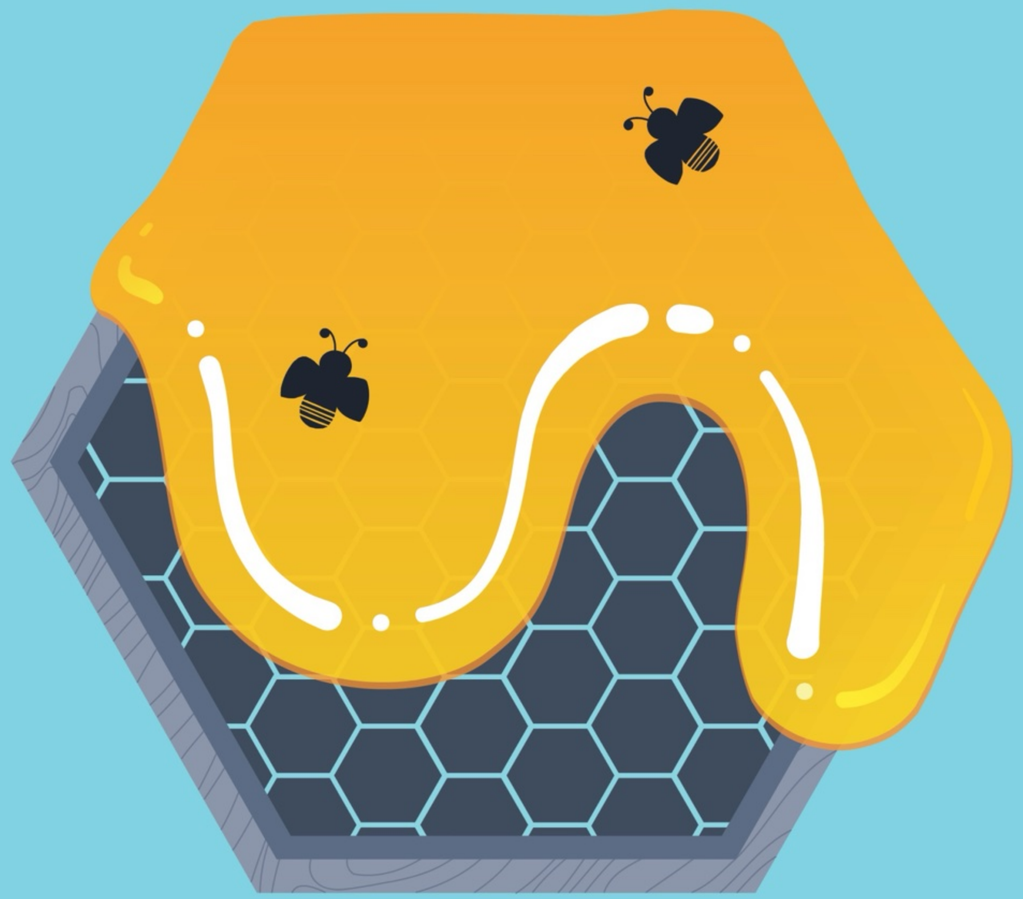


Accelerating clinical algorithm development
through secure collaboration via

Beekeeper AI

UCSF
University of California
San Francisco

Fortanix

intel

Microsoft

How might we accelerate clinical algorithm development by enabling secure collaboration between data stewards & algorithm developers?

Client UCSF

Duration 3 + 6 months

Role UX Lead Designer
UX Researcher

Tags

- Product Design
- Workflow Diagramming
- Qualitative Research
- User Interviews
- Service Blueprint
- Sensemaking
- MVP Prototype Development
- Discovery
- Mid-Fidelity Mockups
- UX Management
- Client Relationship Management
- Sensemaking
- Low-Fidelity Wireframing

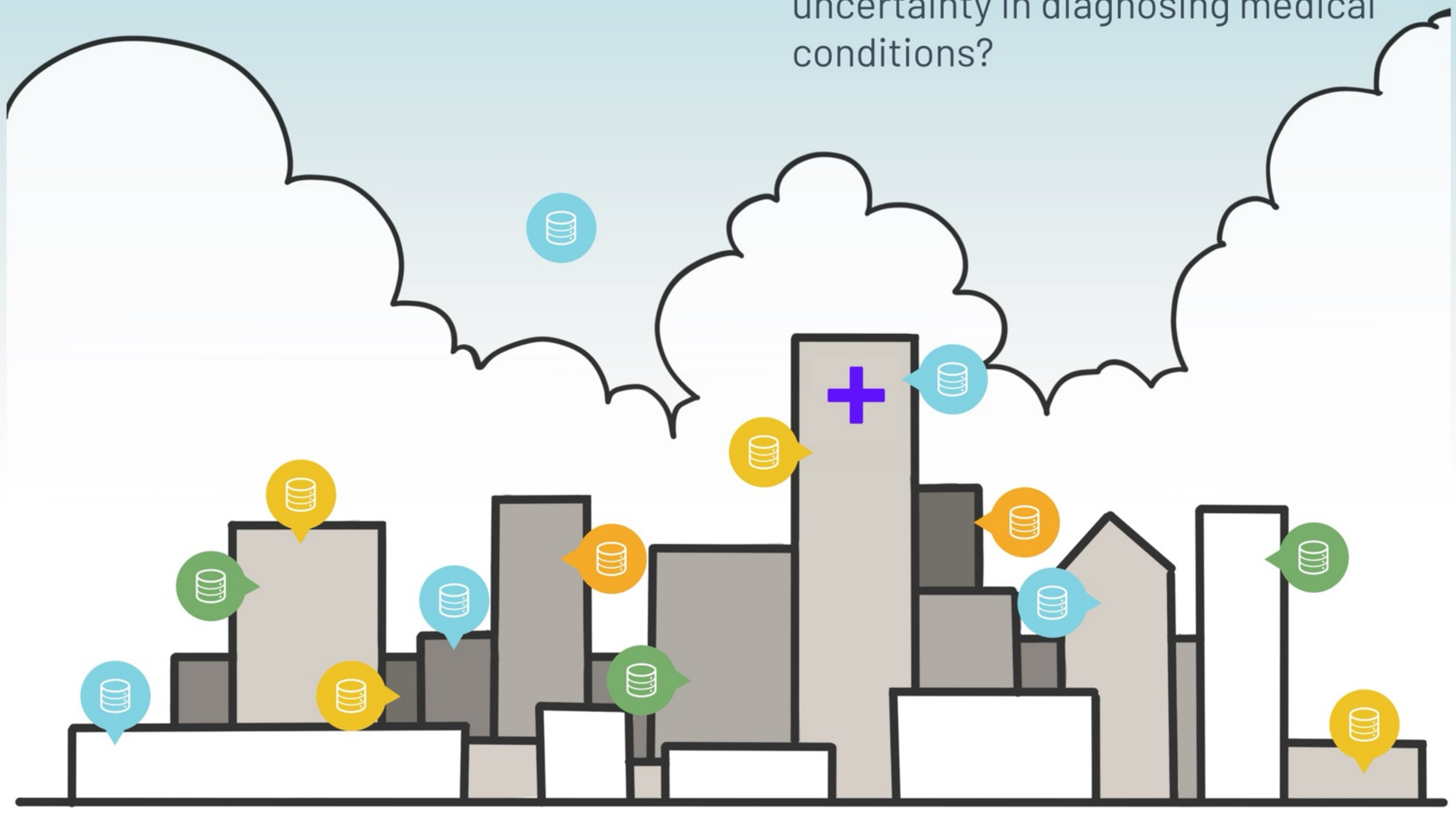
Part 2.1

Background

Healthcare & Technology
AI-based FDA-approved Algorithms
Pain Points

The future of technology is **healthcare**.

What if we could improve patient care by using data to eliminate uncertainty in diagnosing medical conditions?



A collaboration between

UCSF
University of California
San Francisco

The **Use Case** that brought everything together

Fortanix

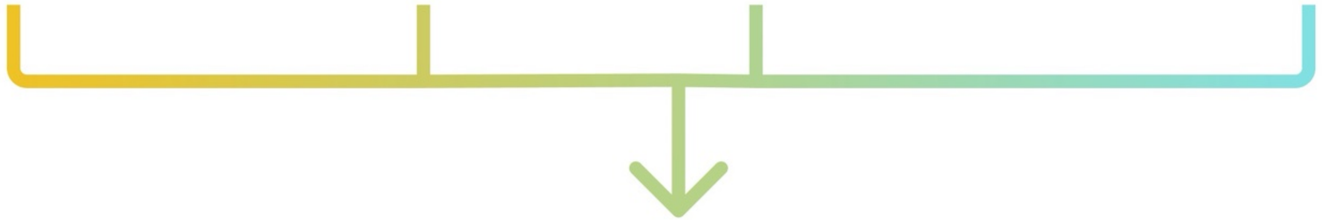
Prior usage of Intel SGX

intel

SGX Hardware

Microsoft

Azure Confidential Computing

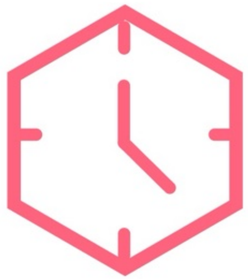


Built by Launch Consulting

How?

with ***Artificial Intelligence-based FDA-approved algorithms***

... but what's standing in the way of this?



Time

It takes approximately **3 years*** for a single clinical algorithm achieve generalizability.

Money

In the same vein, it costs an average **$5 million*** per algorithm.

Trust

Most significant is the mistrust between data owners and algorithm developers.

*in the United States. In other countries, clinical algorithm development is often even more difficult.

The case of Doctor D & Algorithm A —

Doctor D

+

=

More Accurate Diagnoses

Algorithm A

Part 2.2

About BeekeeperAI

Algorithm Owners vs. Data Stewards
What is BeekeeperAI?
How does it work?

Algorithm Owner

AI development teams from 3rd parties or AMC's

Develop algorithms for FDA approval and future clinical usage

Goal: Create an algorithm that passes FDA approval and achieves generalizability (usable by practitioners)

Data Steward

Academic medical centers (AMC's), often university hospital systems

Guard & process vast lakes of patient data

Goal: Advance healthcare technology while keeping patient data safe (and earning a bit of profit at the same time)

BEEKEEPERAI

a zero-trust platform connecting **data stewards** and **algorithm owners** (as a 2-sided marketplace) in order to collaborate for the *advancement of clinical algorithm development*.

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DATASET

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ALGORITHM

BEEKEEPERAI

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ALGORITHM

a zero-trust platform connecting **data stewards** and **algorithm owners** (as a 2-sided marketplace) in order to collaborate on the advancement of clinical algorithm development

"Zero trust (ZT) is the term for an evolving set of cybersecurity paradigms that move defenses from static, network-based perimeters to focus on users, assets, and resources...

Zero trust assumes there is no implicit trust granted to assets or user accounts based solely on their physical or network location or based on asset ownership."

The National Institue of Standards and Technology, U.S. Department of Commerce

https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.800-207.pdf

Data Steward

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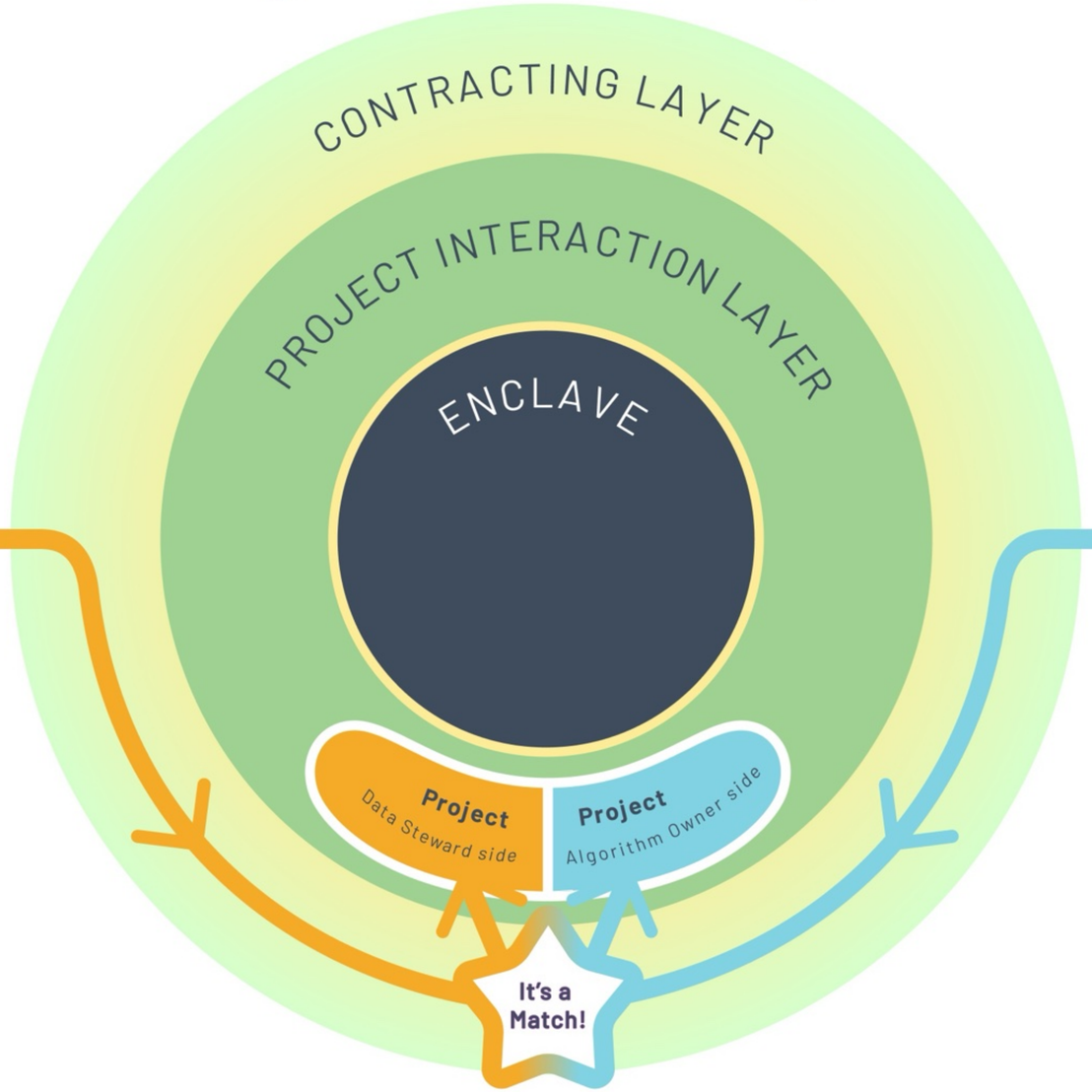
BEEKEEPERAI



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BEEKEEPERAI

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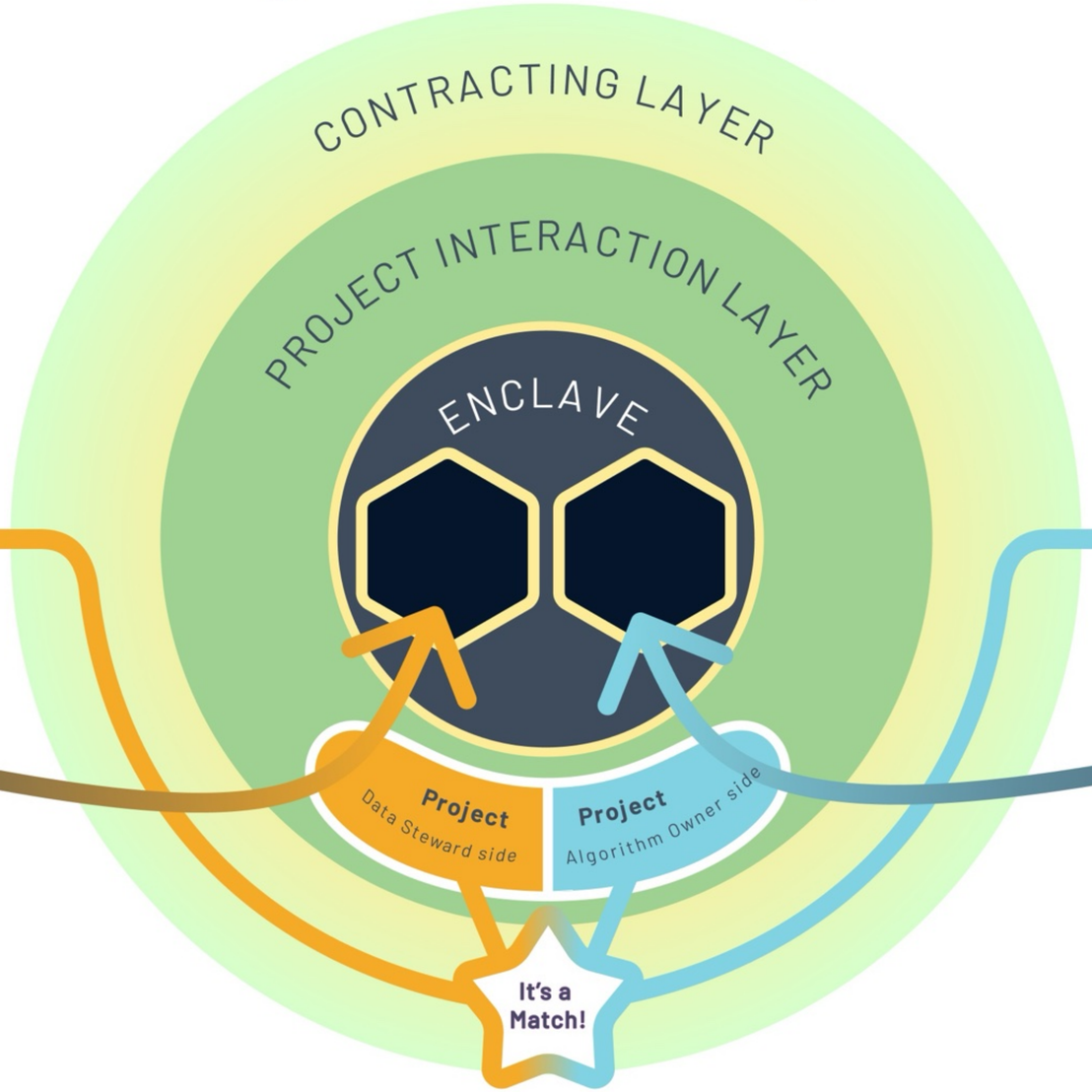

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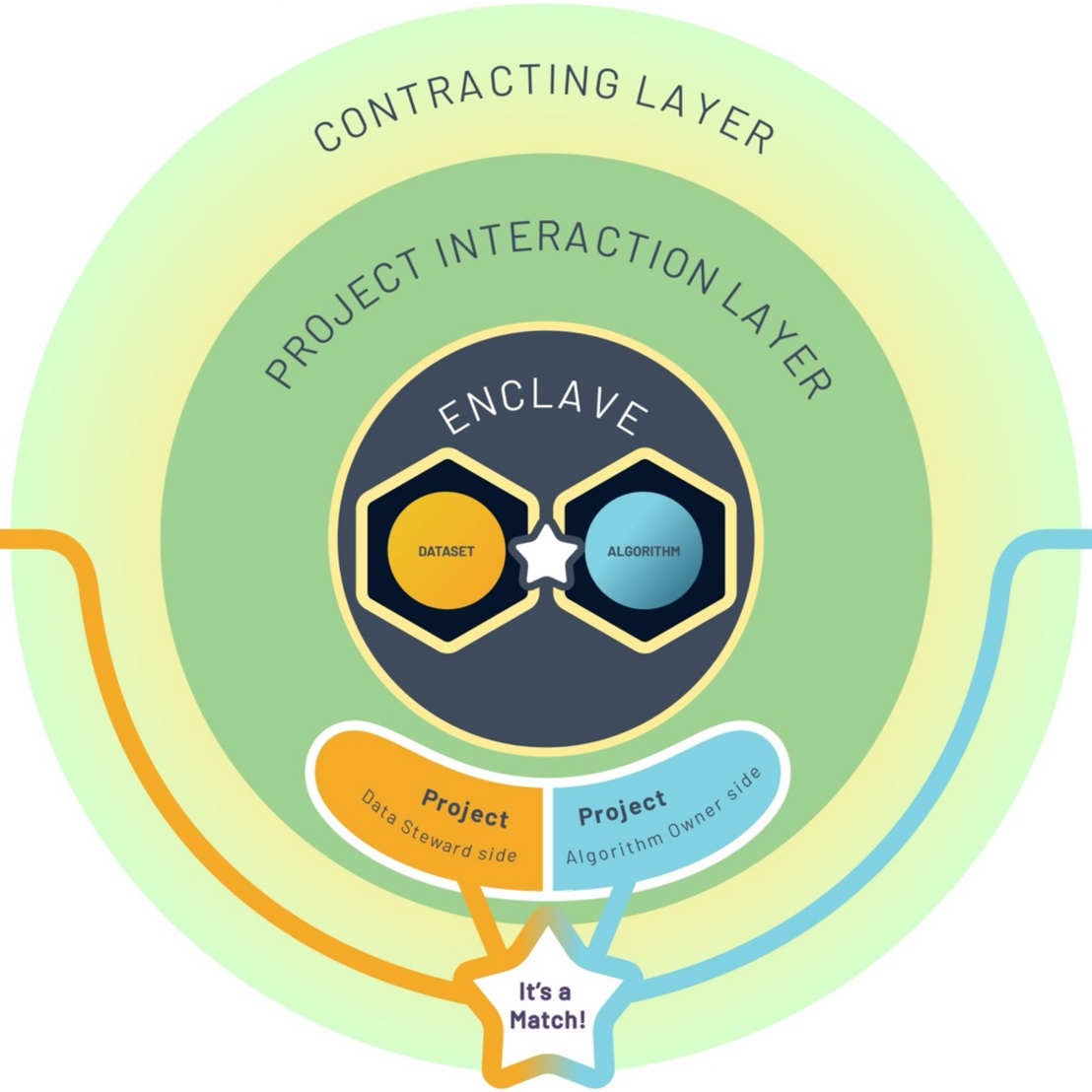

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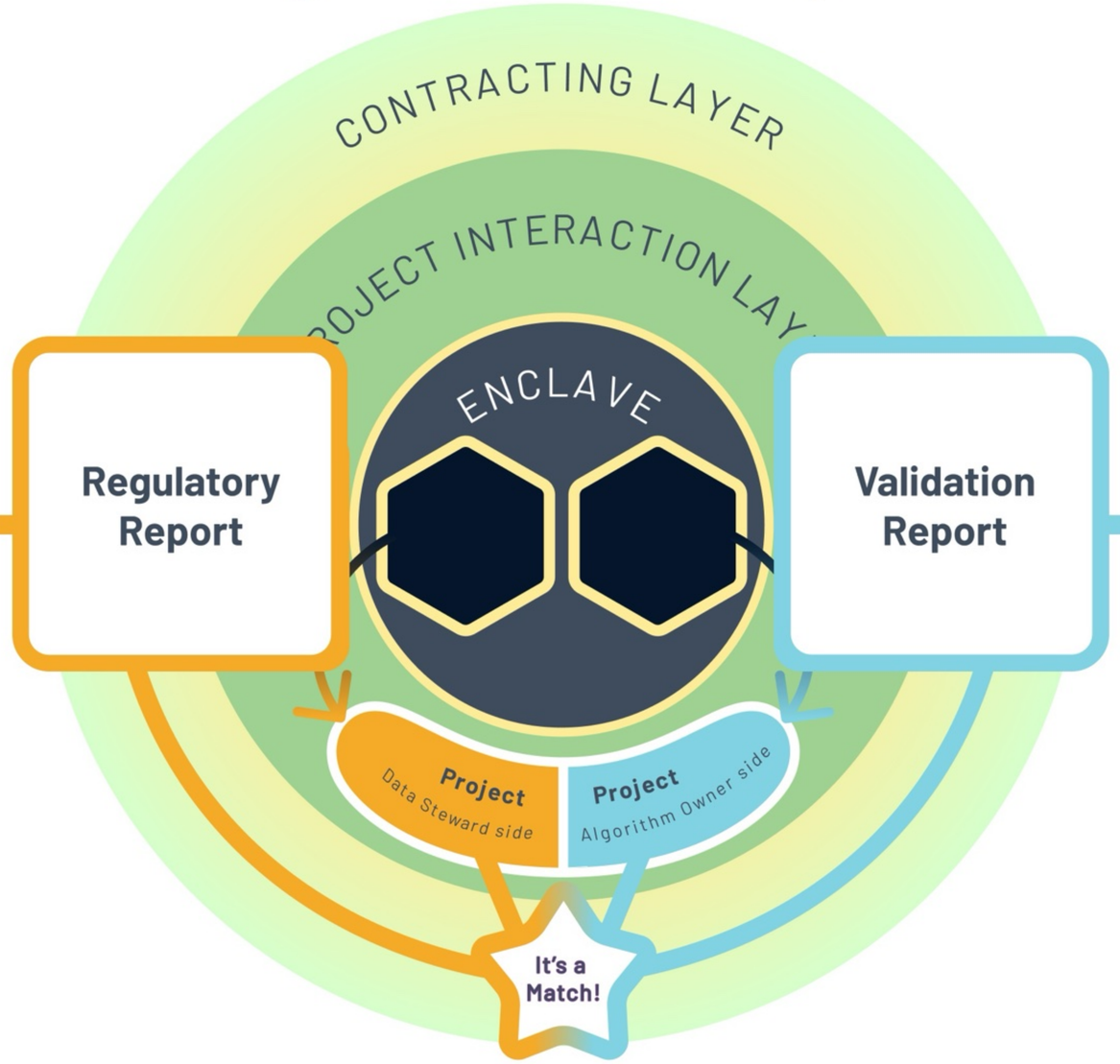

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ALGORITHM

BEEKEEPERAI

Data Steward

Academic medical centers (AMC's), often university hospital systems

Guard & process vast lakes of patient data

Goal: Advance healthcare technology while keeping patient data safe (and earning a bit of profit at the same time)

Regulatory Report

"I now have a record that this algorithm ran against my dataset."

Utilization Profit

Future Academic Clout

Validation Report

"Does my algorithm perform as expected against this dataset?"

Feedback for future improvements

Algorithm Owner

AI development teams from 3rd parties or AMC's

Develop algorithms for FDA approval and future clinical usage

Goal: Create an algorithm that passes FDA approval and achieves generalizability (usable by practitioners)

Part 2.3

Engagement 1: Proof of Concept

Planning & Research

Scope of Engagement
Preview of Final Deliverable
Research & IA process

Engagement 1

Proof of Concept

Data Steward

Academic medical centers (AMC's), often university hospital systems

Own & process vast lakes of patient data

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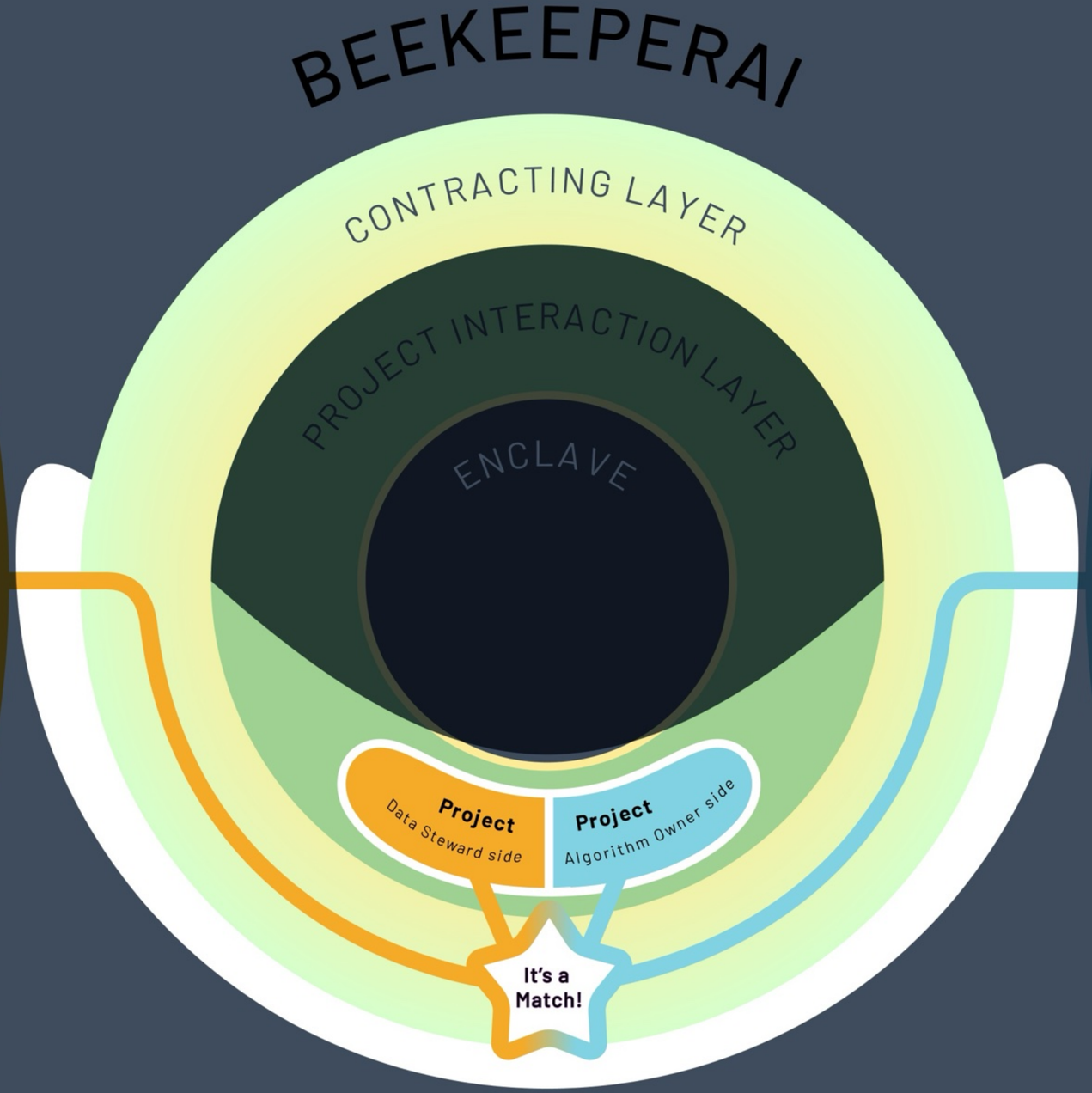


Algorithm Owner

AI development teams from 3rd parties or AMC's

Develop algorithms for FDA approval and future clinical usage

ALGORITHM

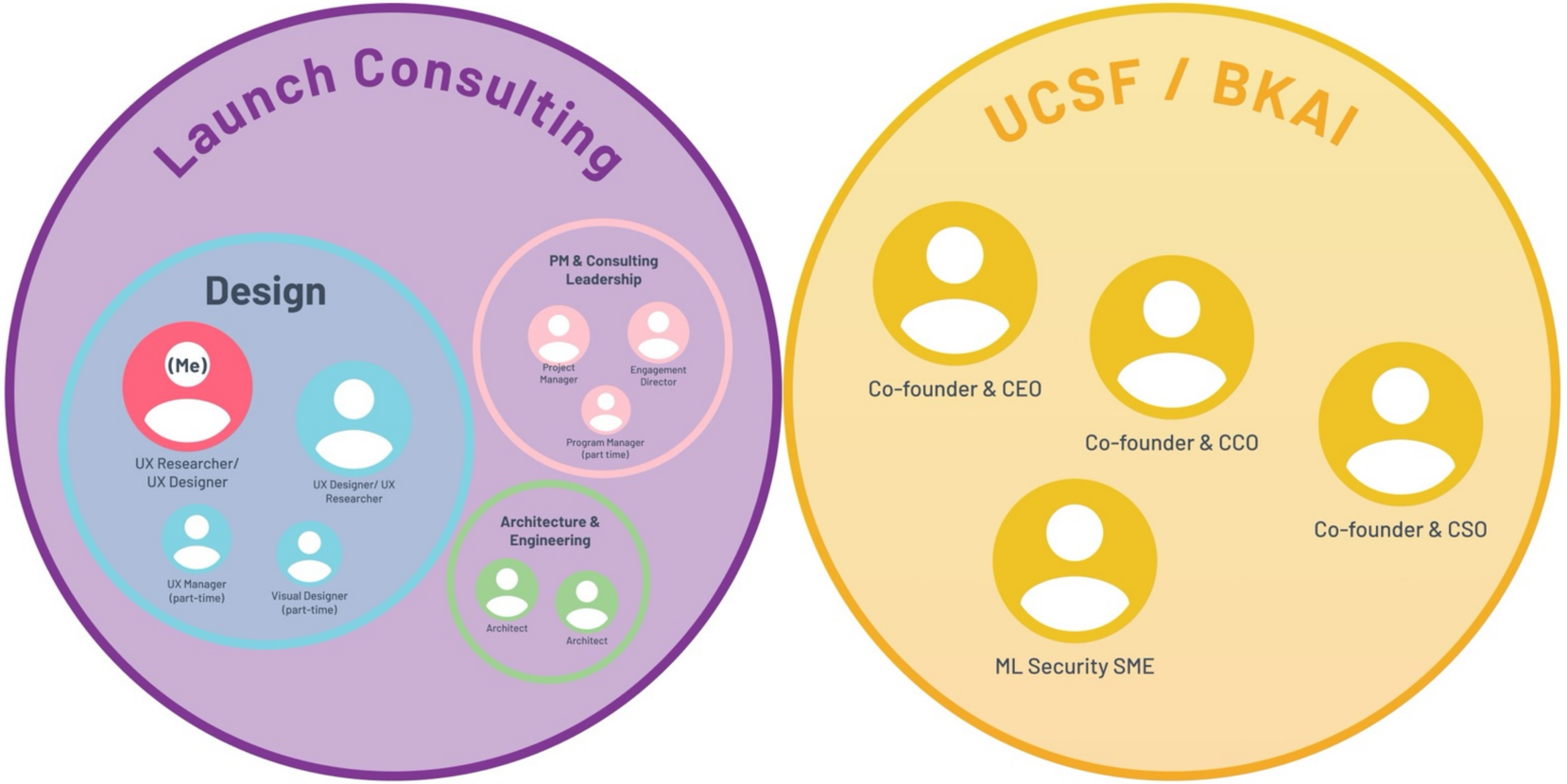
Engagement 1

Proof of Concept

3 months

March 2021 — April 2021 — May 2021 — June 2021

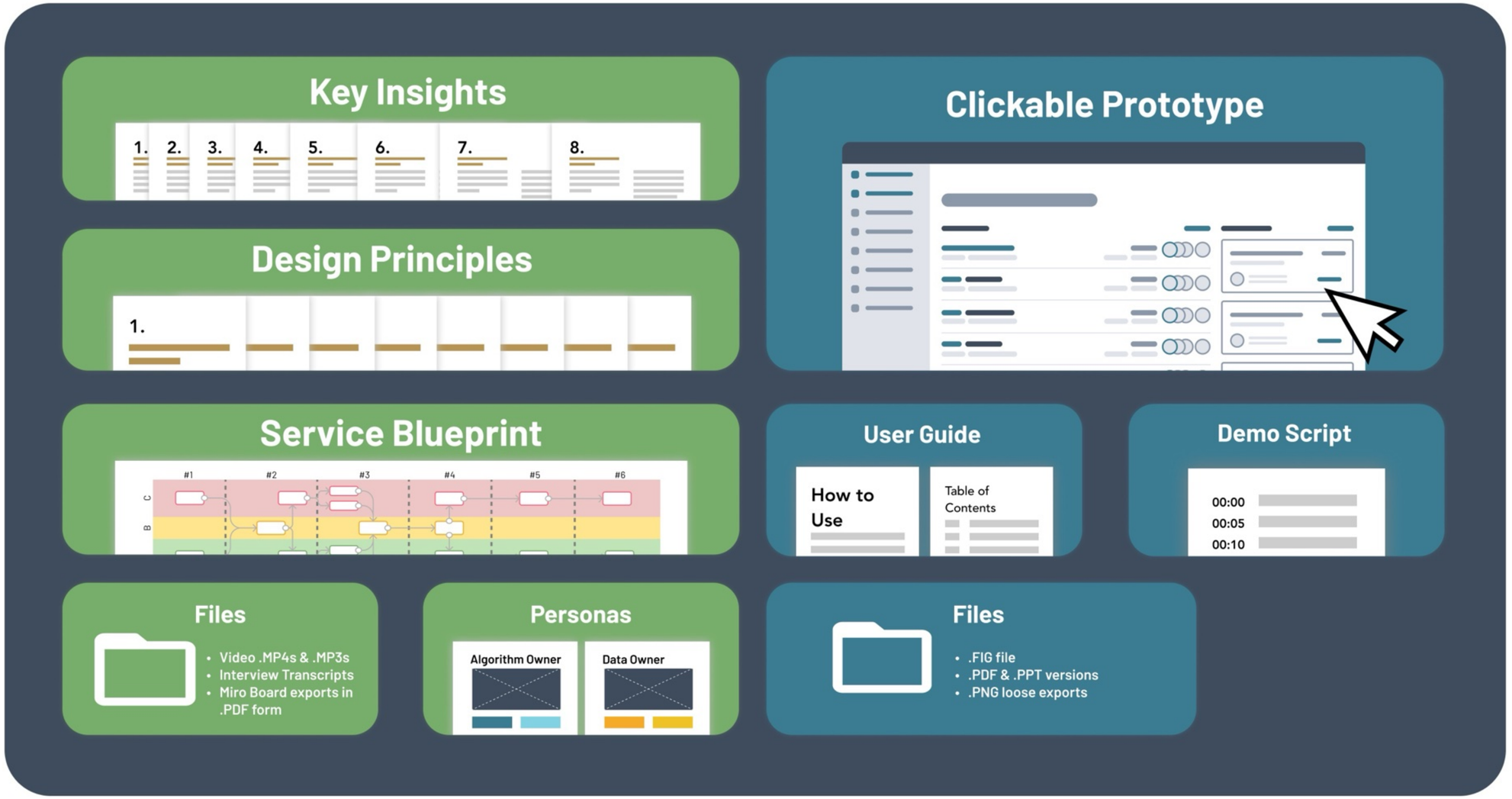
Create a demo-able **clickable prototype** so that BKAI can raise funding from investors & gauge interest with prospective customers



Engagement 1

Proof of Concept

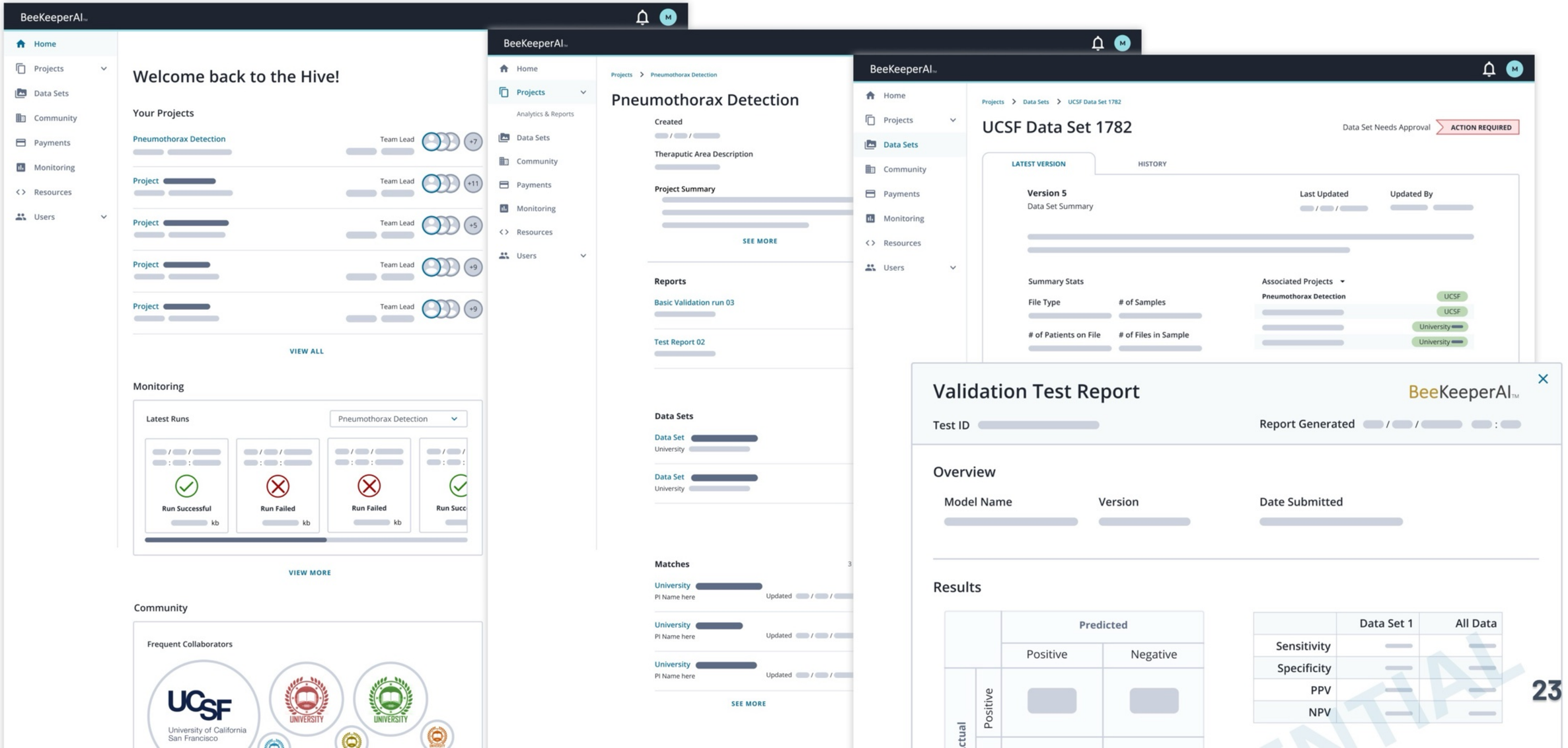
End result



Engagement 1

Proof of Concept

End result

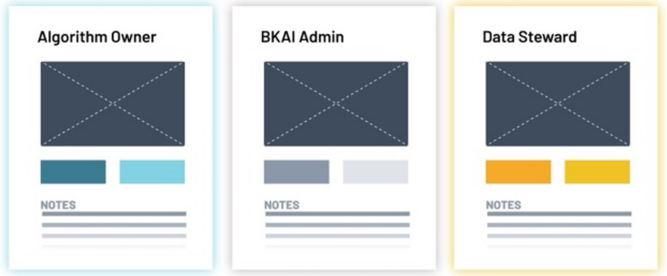


Engagement 1

Proof of Concept

START: User Personas

Client Product Owners prepared these 3 key personas as a starting point, which we confirmed & fleshed out with our research.

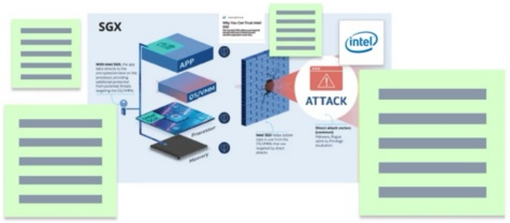


Clickable Prototype – **Development Process Map**

How did we build out this initial prototype within 3 months?

1. Secondary Research

We're using SGX... so what is it?



terminology/regulations from

Key concepts from these industries:

- Data Science
- Healthcare Regulation
- AI/ML in Healthcare

2. Primary Research

5 Data Stewards &
6 Algorithm Owners

"What are the major pain points that you struggle with (and how can BKAI help)?"

I turned my notes into insights, which I then grouped & distilled 2x into overall insights.

Engagement 1

Proof of Concept

3. Key Findings

Some particularly interesting data points I learned from our research distillation:

Algorithm Owner

- Any risk of algorithm IP leaking is too much risk.
- Building products = hitting milestones, improving the product, and achieving sign off from FDA
- The standard for good data is: de-identified, easily available, and have a lot of work put into it (good annotations & context/logic)
- AO's are at the mercy of the data they need to obtain, and just because a data point exists doesn't mean it's easy/feasible to extract it
- **Just about all the users we talked to (interested future customer representatives) are hopeful but doubtful of Beekeeper's future effectiveness**

Data Steward

- **#1 goal: DOs want to avoid risk of data loss/exposure**, and then #2 goal: create innovative health solutions to make clinicians' jobs easier. DOs do actually want to share their data for innovations in healthcare, but this goal is #2 after managing risk.
- Important for the DO to be aligned/ have trust in the AO. Collaboration between multiple sites is very hard (both data + interpersonal problems)
- Monetization (though beneficial) is a controversial topic to talk openly about with AMCs
- **Could Beekeeper be an opportunity to define standards for data?**

Engagement 1

Proof of Concept

4. Service Blueprint

I mapped out the exact sequence of events that our prototype needs to support into a step-by-step journey, and overlaid possible future touchpoints on top.

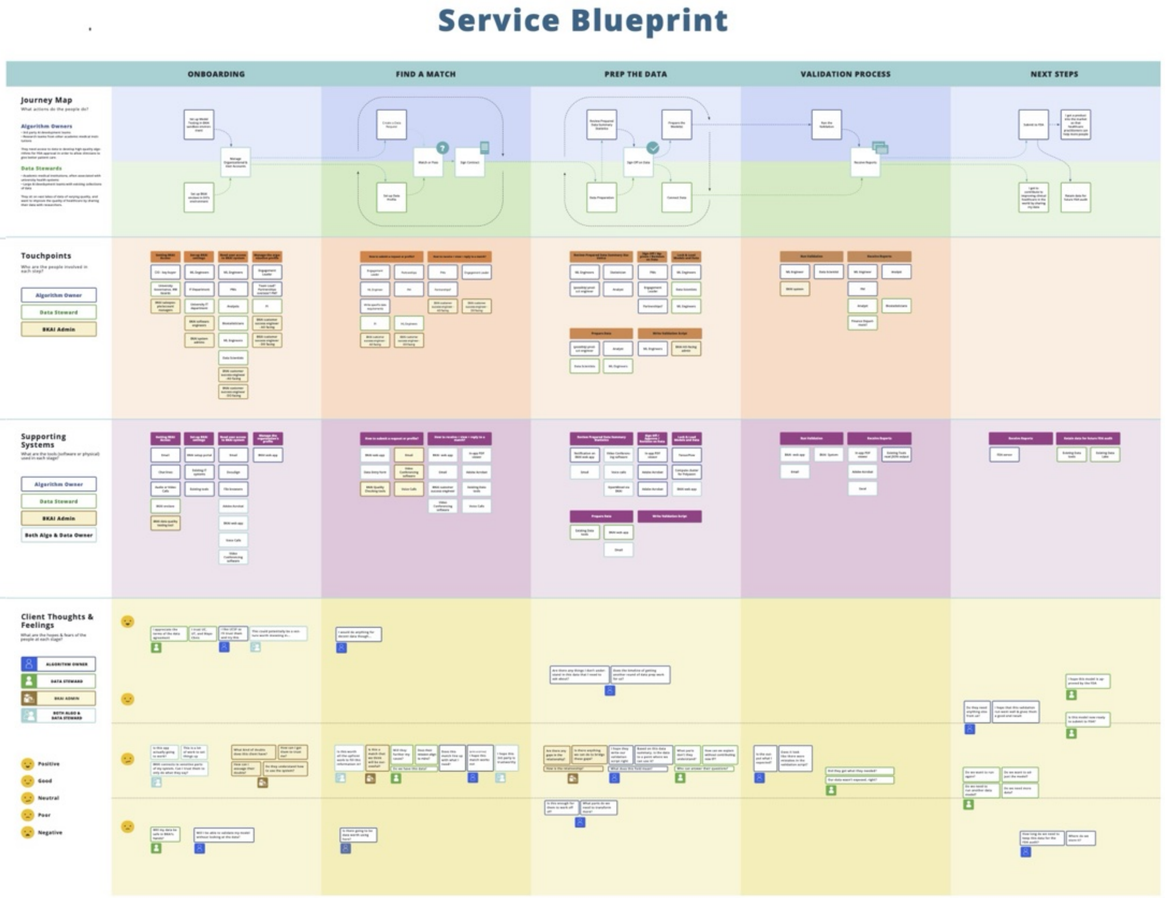
Journey Map
Outlines the major steps that each user persona takes through each stage of the process

Touchpoints
Identifies the specific (hypothetical) people involved in each step

Supporting Systems
Identifies the specific (hypothetical) tools, both software & physical, used in each stage

Client Thoughts & Feelings

Extrapolates the (hypothetical) hopes & fears of each user persona through each stage, from positive -> negative

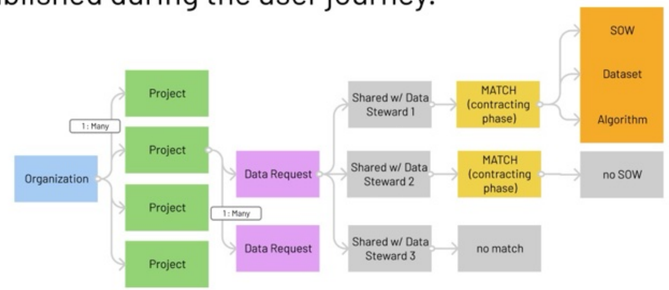


Engagement 1

Proof of Concept

6. Information Architecture

We developed the IA model based on the sequence of events established during the user journey.



7. Rough Story Sequence

We made some important decisions & finalized our storyline.

Question	Answer	Why/How
Point in Time: MVP or future?	2 years in the future	Client group via online workshop via Miro
POV: AO, DS, or Both?	Algorithm Owner only	Most actions are on the AO side, time limit, difficulty switching POV's
New user OR Existing user?	Existing User only	Onboarding/setup is non-essential, time limit
Fidelity of final prototype?	Medium Fidelity	No High Fidelity: viewers expect perfect data, time limit

5. Key Feature Selection

We asked the client Product Owners to decide what features were the most quintessential to BKAI's story. This enabled us to concentrate on what's most important to build for the final solution.

Part 2.4

Engagement 1: Proof of Concept

Design

Storyline
Low Fidelity -> High Fidelity (x3 features) Designs
Conclusion

Engagement 1

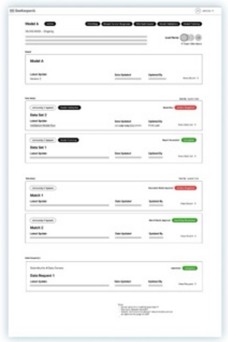
Proof of Concept

8. Storyline & Wireframing

We finalized our prototype's story structure and built wireframes accordingly, pausing to test with our Product Owners and specific users.

1. Welcome & Home

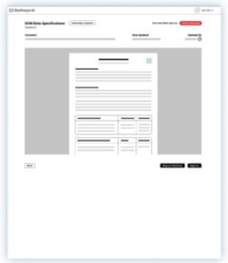
2. Projects



3. New Data Request

4. Match!

5. SOW



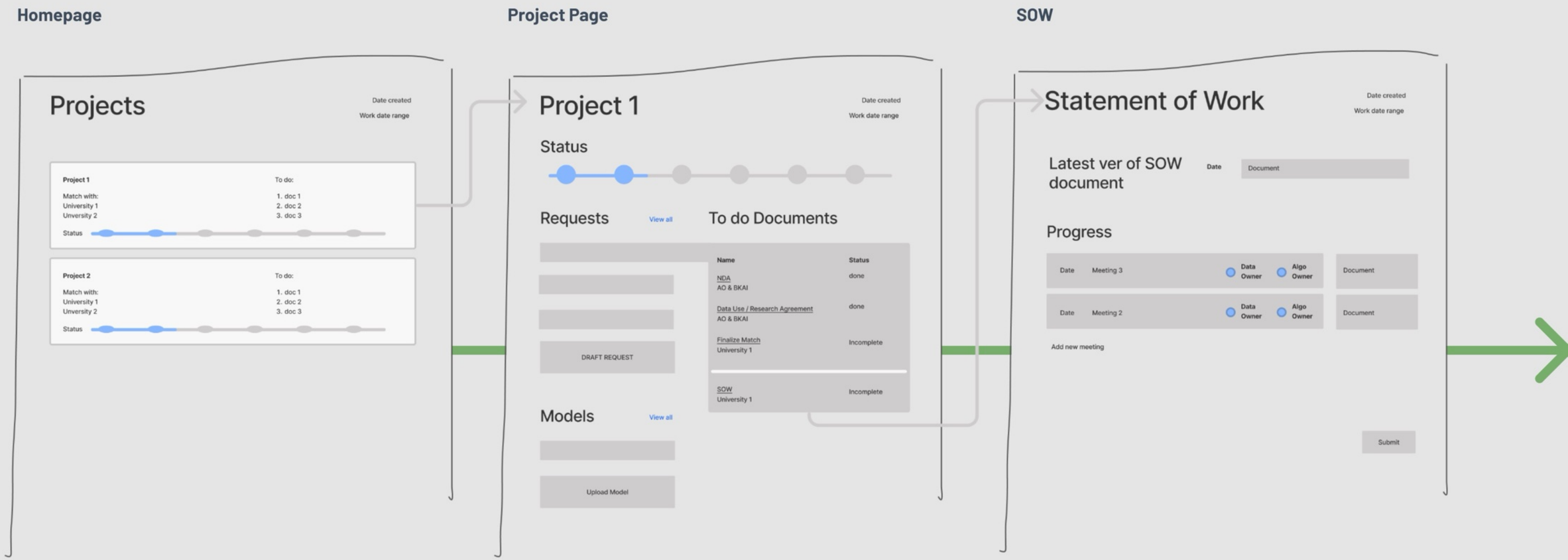
6. View Dataset & Approval

7. Run & Report

Engagement 1

Proof of Concept

Low-Fidelity

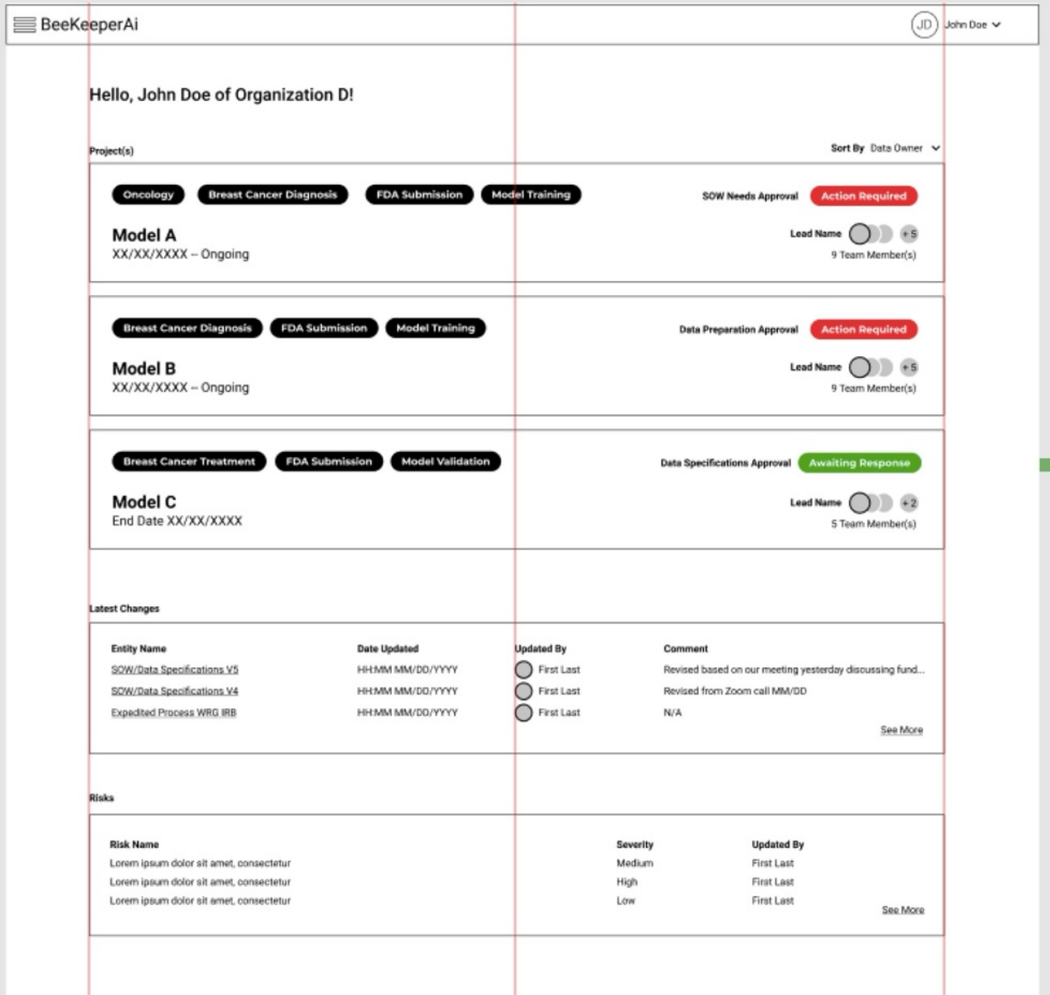


Engagement 1

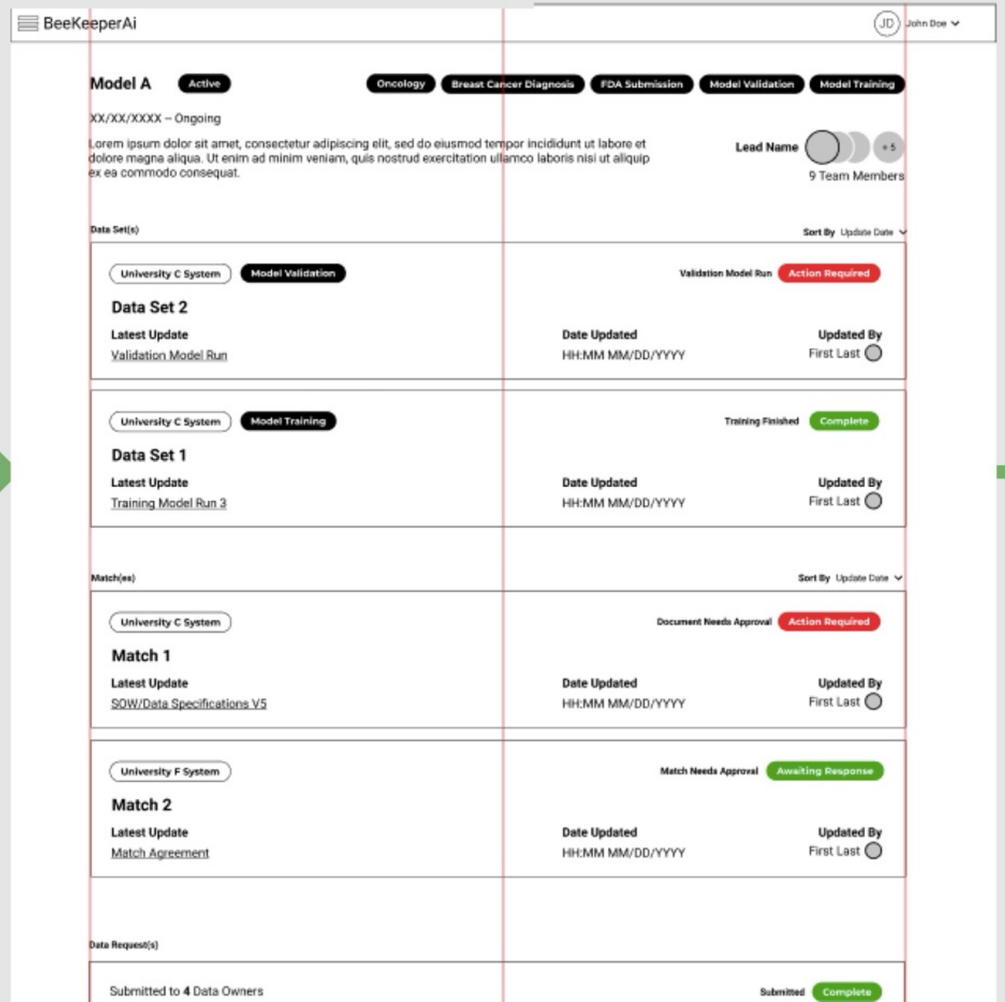
Proof of Concept

Low-Fidelity

Homepage



Project Page

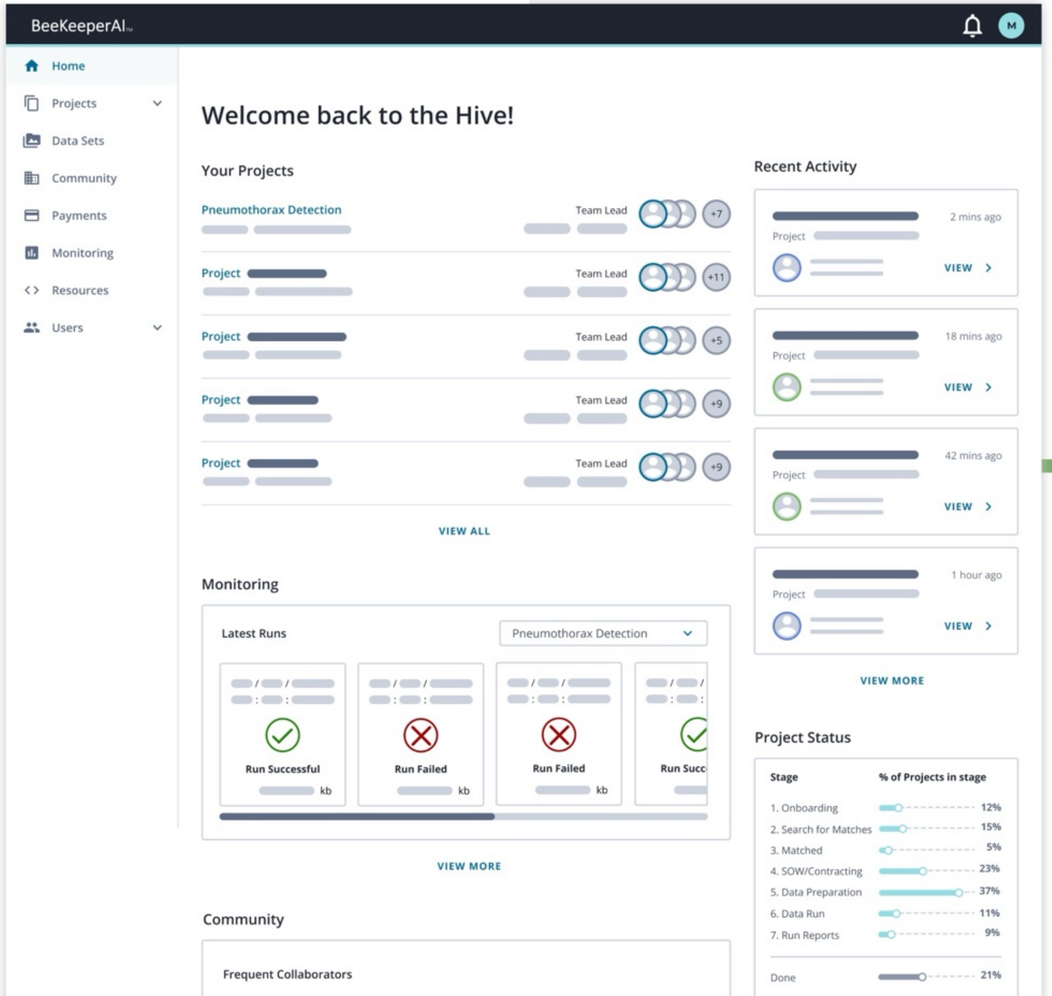


Engagement 1

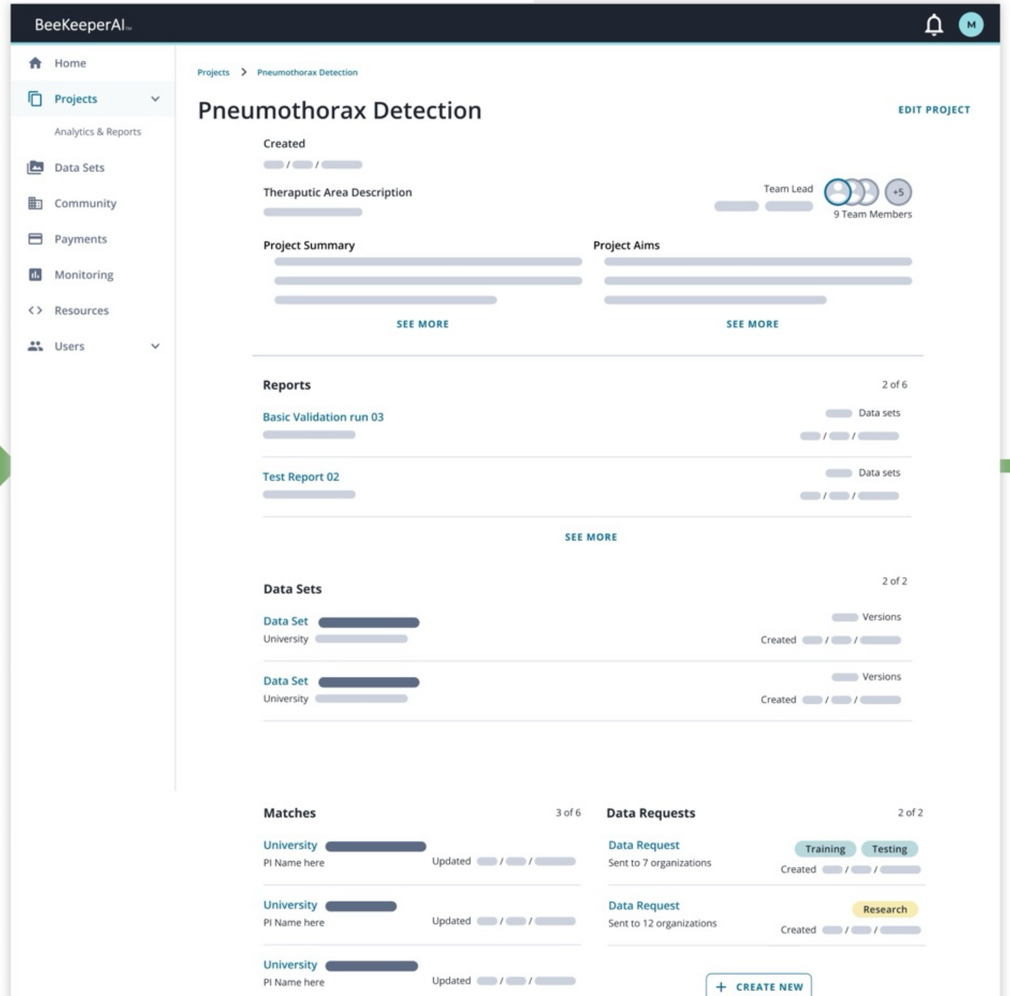
Proof of Concept

Mid/High-Fidelity

Homepage



Project Page

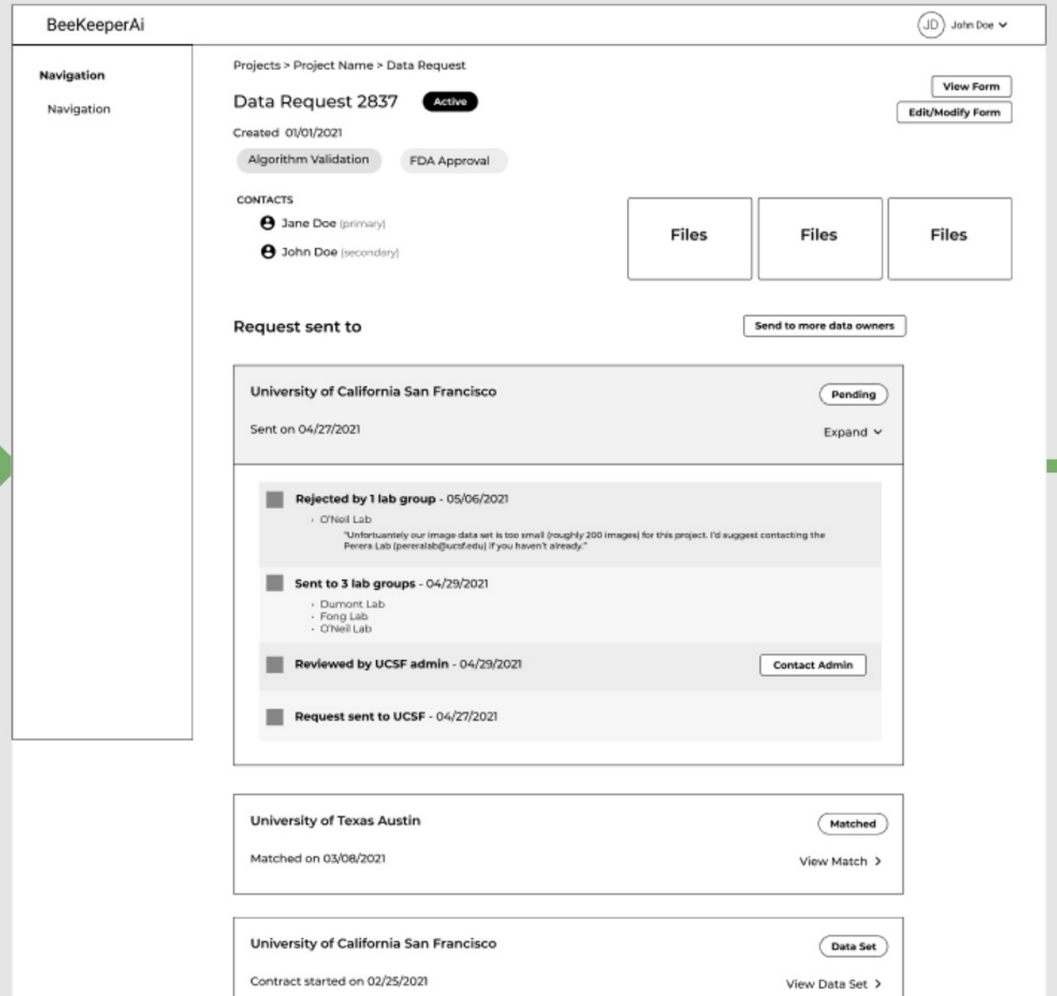


Engagement 1

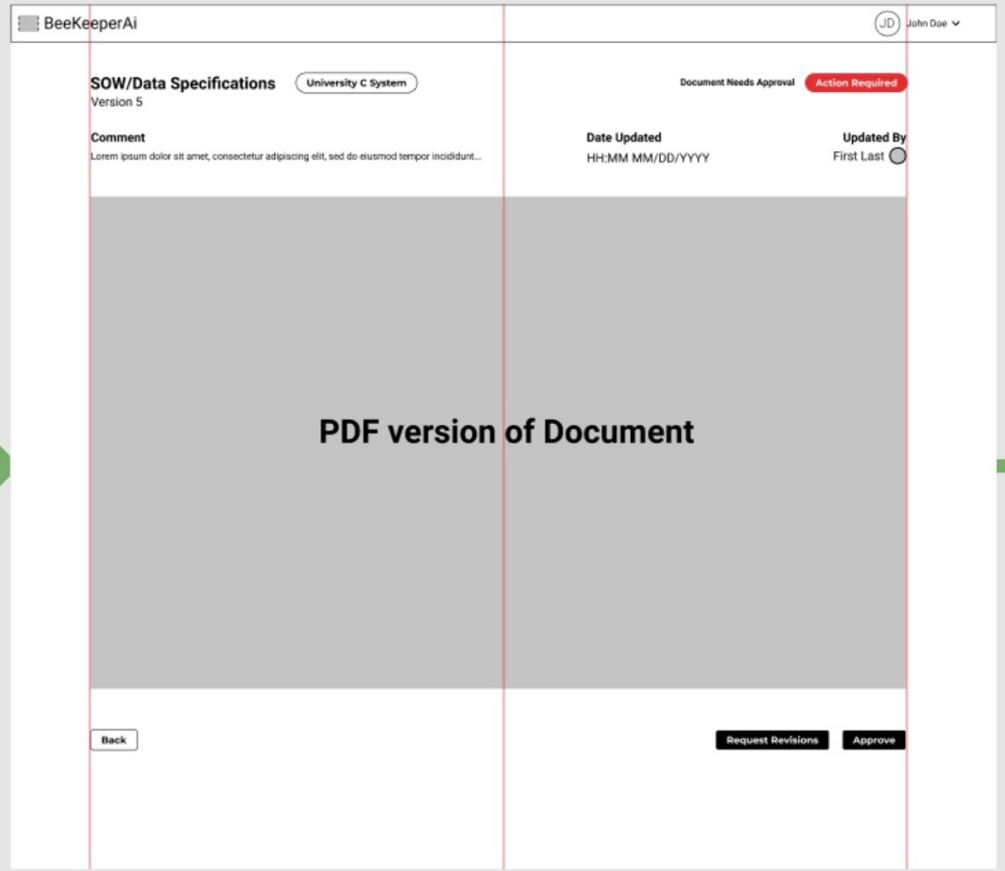
Proof of Concept

Low-Fidelity

Matches



Sign SOW



Engagement 1

Proof of Concept

Mid/High-Fidelity

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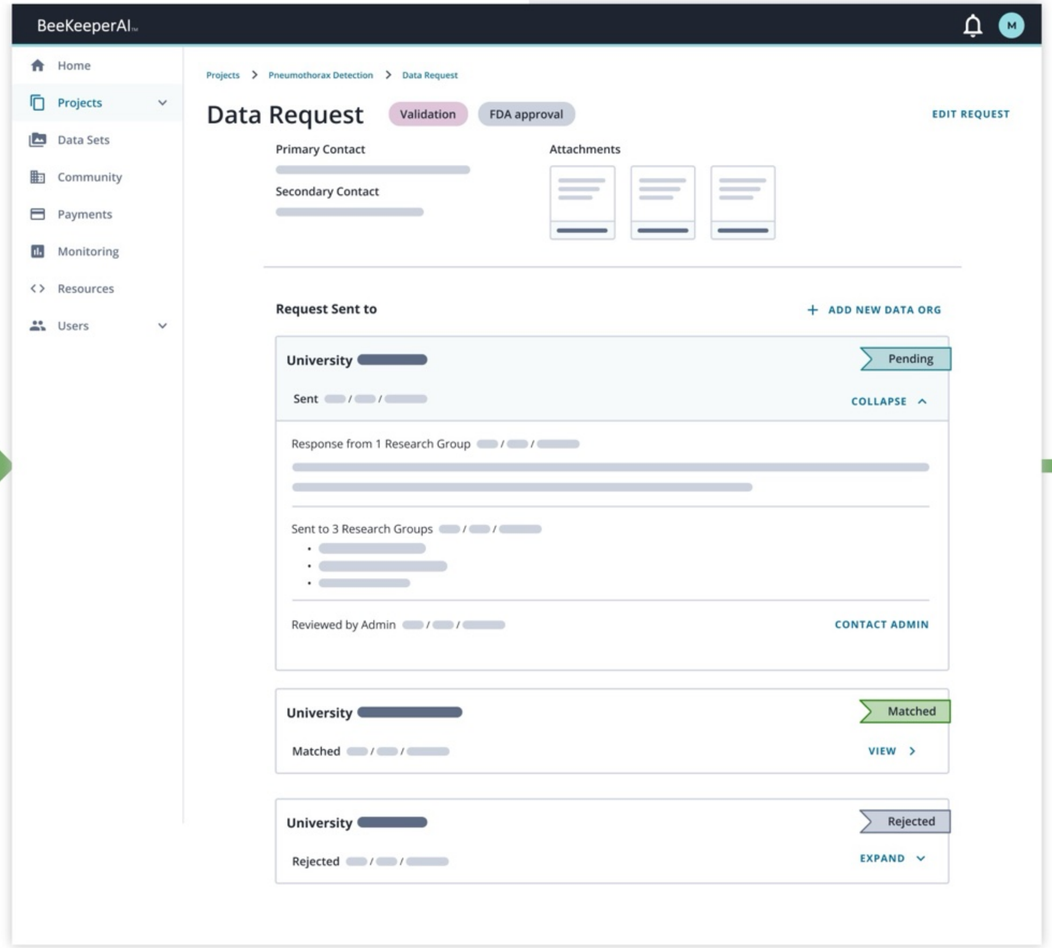

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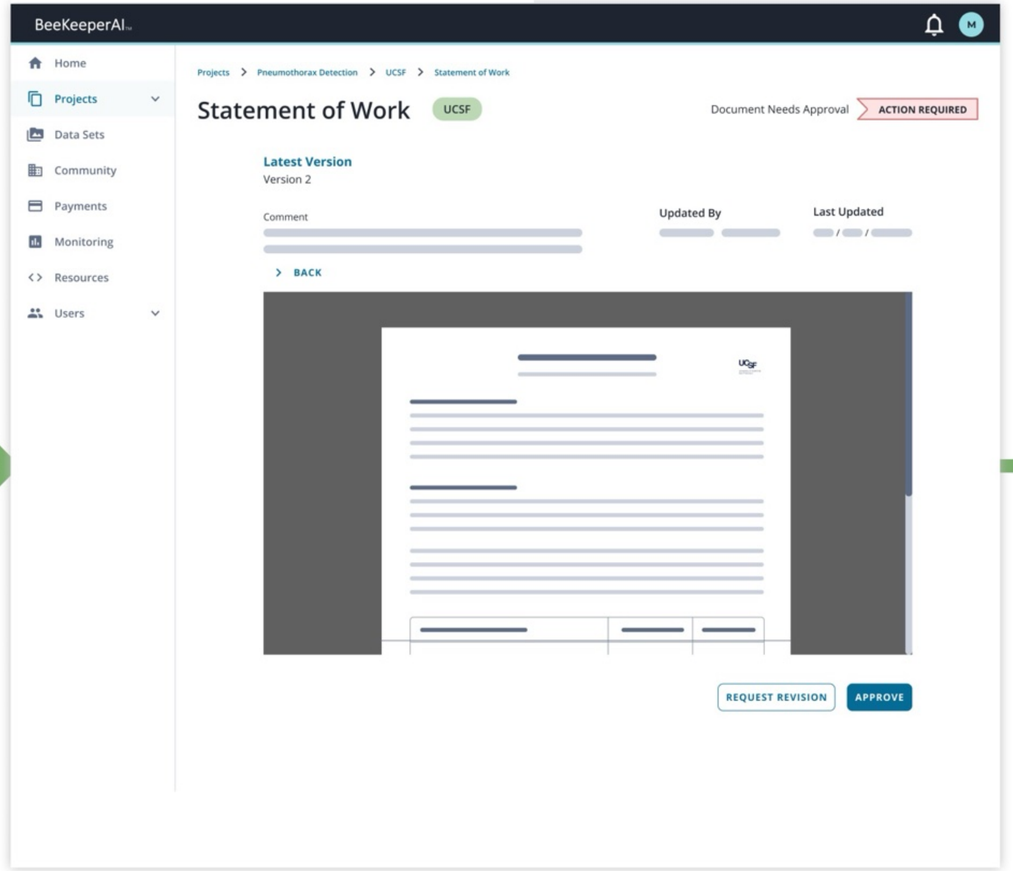
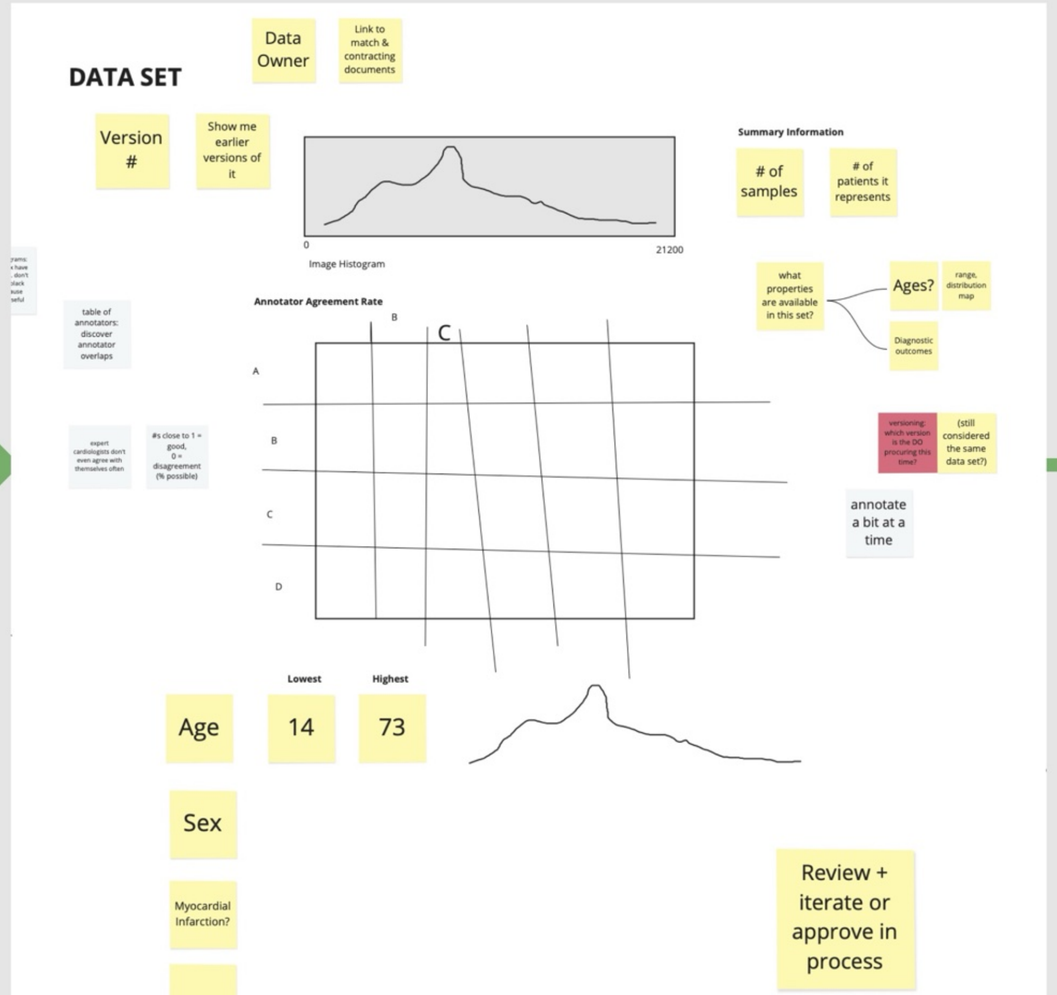


Engagement 1

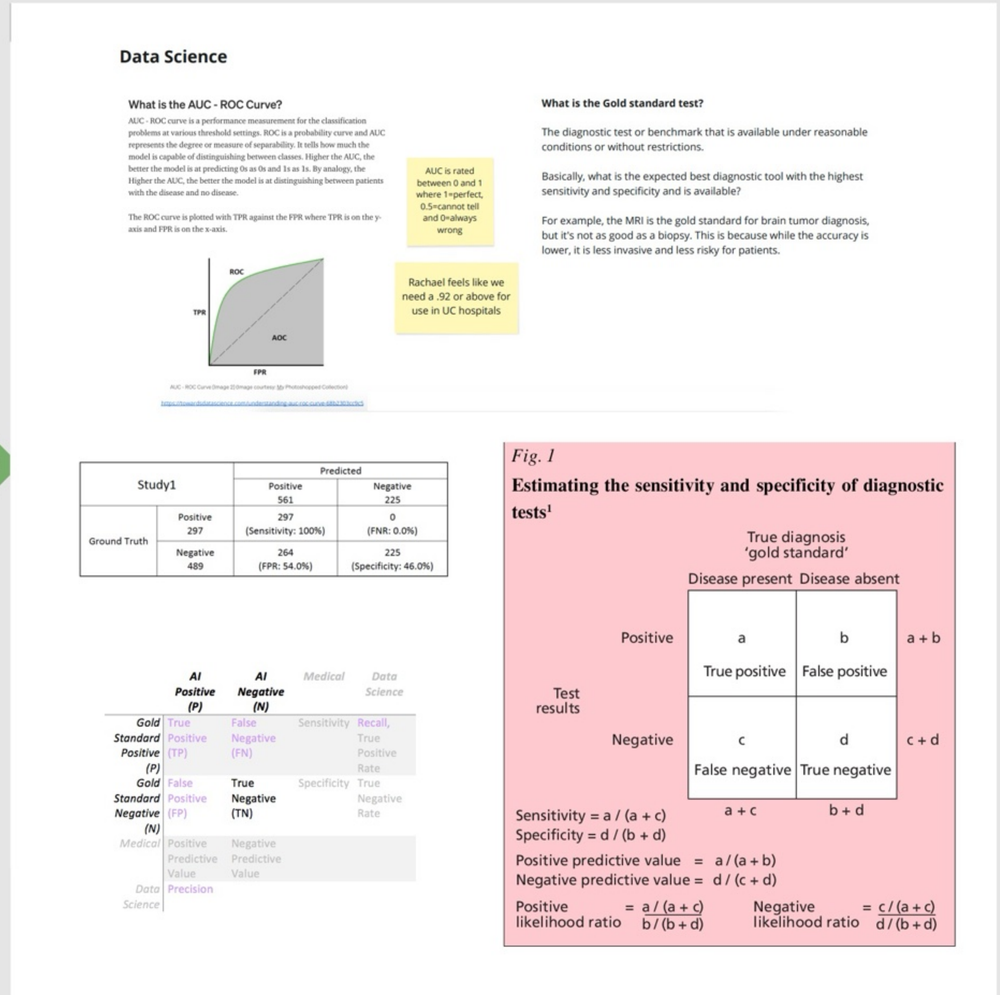
Proof of Concept

Low-Fidelity

View Dataset



Validation Report

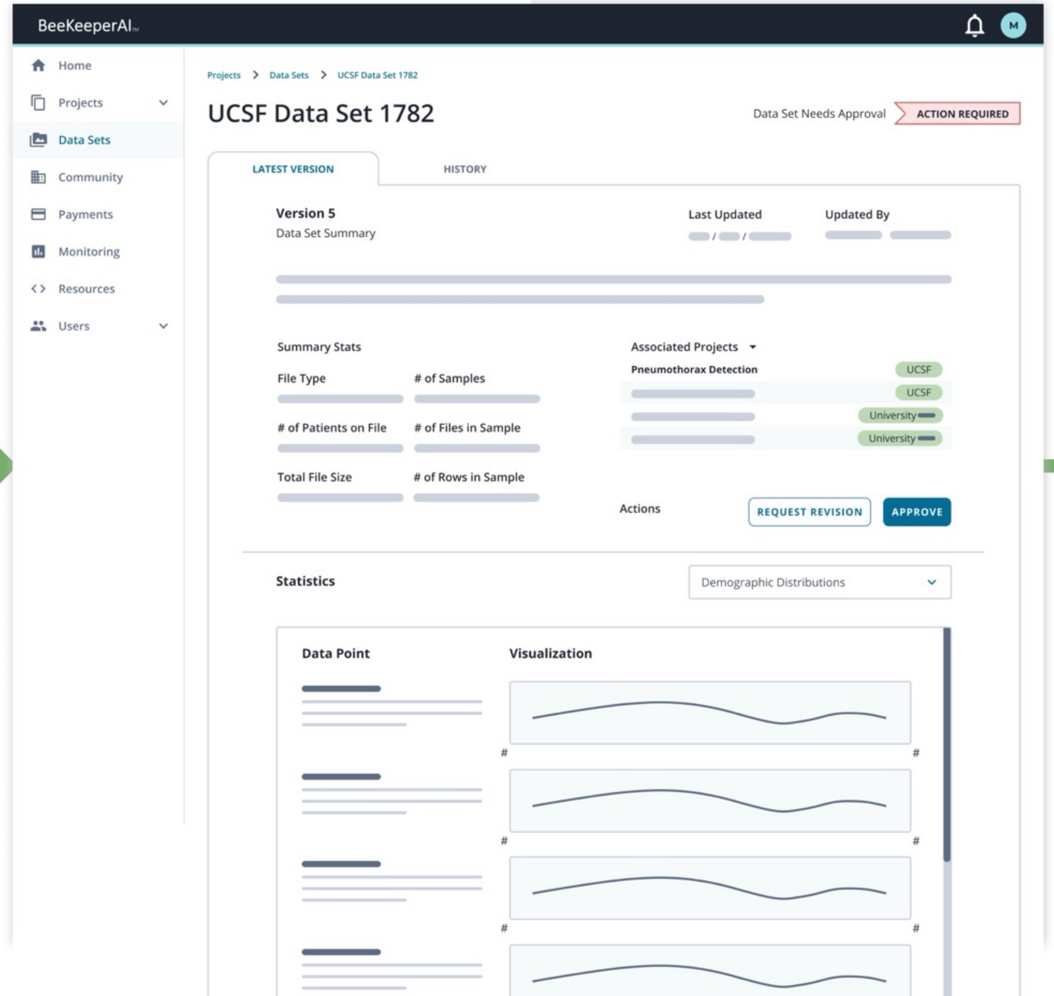


Engagement 1

Proof of Concept

Mid/High-Fidelity

View Dataset



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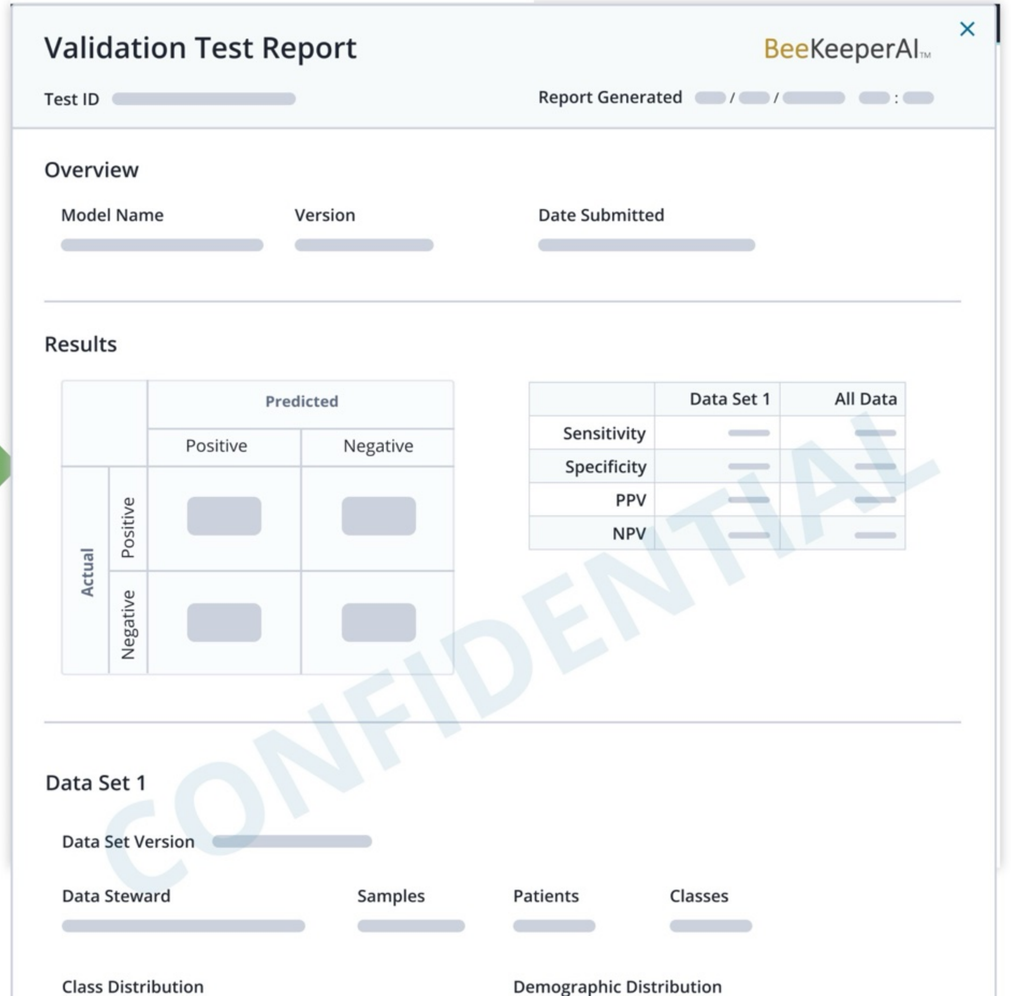


Engagement 1

Proof of Concept

9. Final Delivery

We built out our final mid-fidelity pages using our own custom elements kit, added clickability, and delivered the following to our clients:

Intro of materials & where to find them, what situations to use them in

Example verbal script to use to tell the clickable prototype story

The Clickable Prototype itself via Figma (.fig) and URL, and exported .png & .pdf files

Conclusion

As of June 2021, BeekeeperAI is ready to publicly use our demo-able prototype to gain investor funding & potential customers to go out and build the real thing.

Part 2.5

Engagement 2: MVP

Planning & Research

Scope of Engagement
Preview of Final Deliverable
Requirements Planning & Usability Testing Process

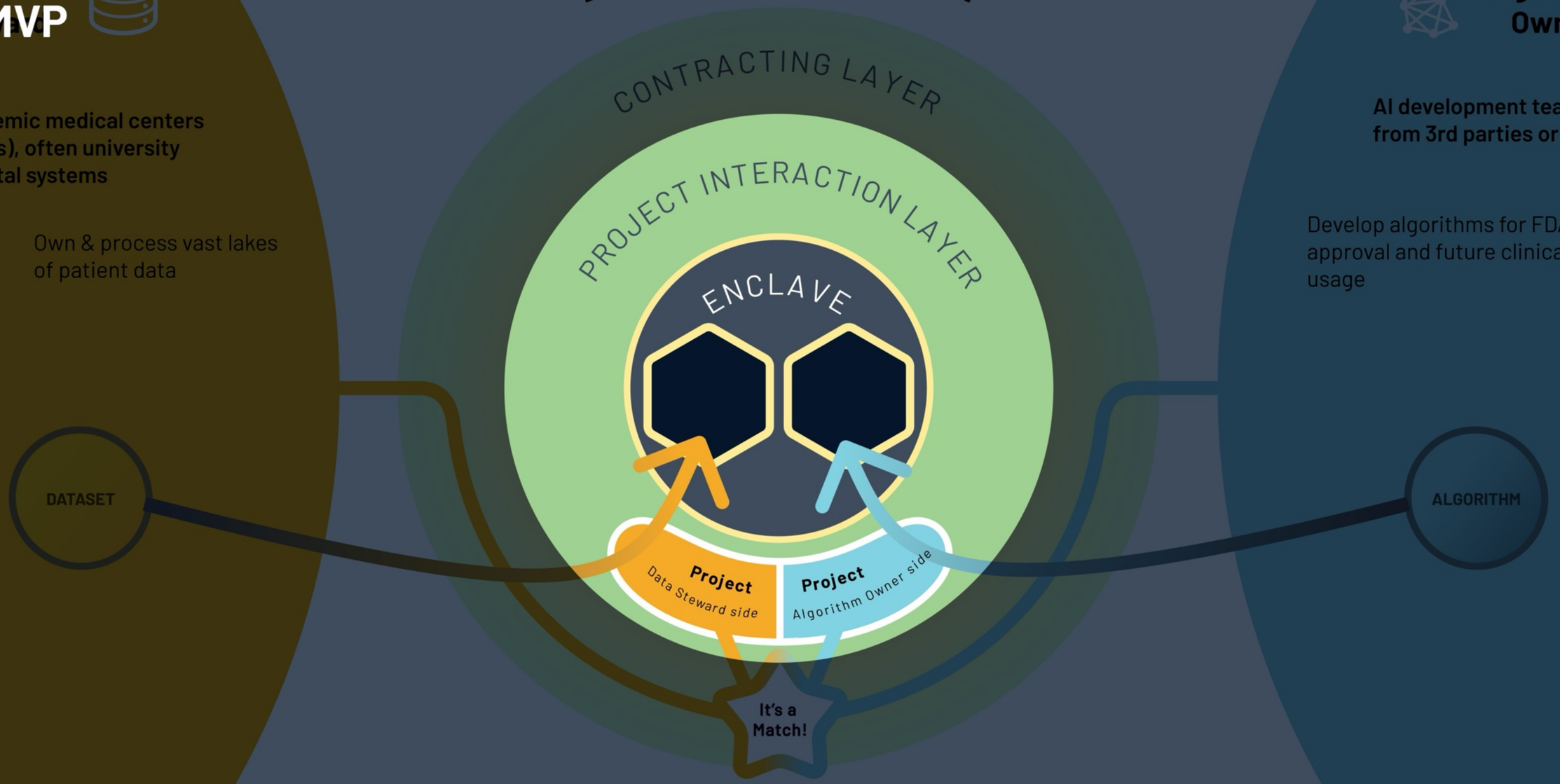
Engagement 2

Data Steward MVP

Academic medical centers (AMC's), often university hospital systems

Own & process vast lakes of patient data

BEEKEEPERAI



Algorithm Owner

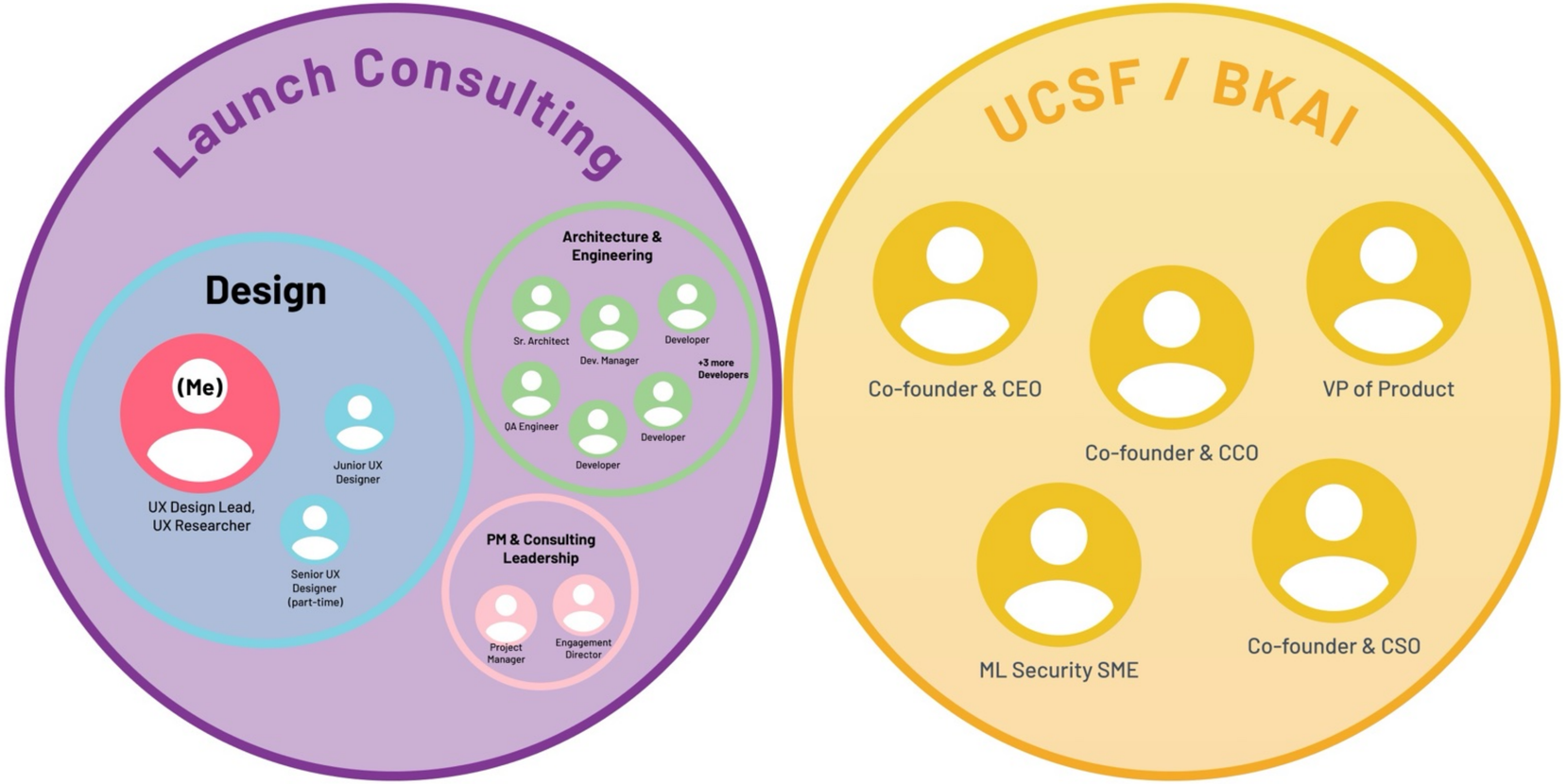
AI development teams from 3rd parties or AMC's

Develop algorithms for FDA approval and future clinical usage

Engagement 2

MVP

Build the EscrowAI (excluding Matching) **MVP product** so that 1st priority pilot customer users can perform their first commercial runs



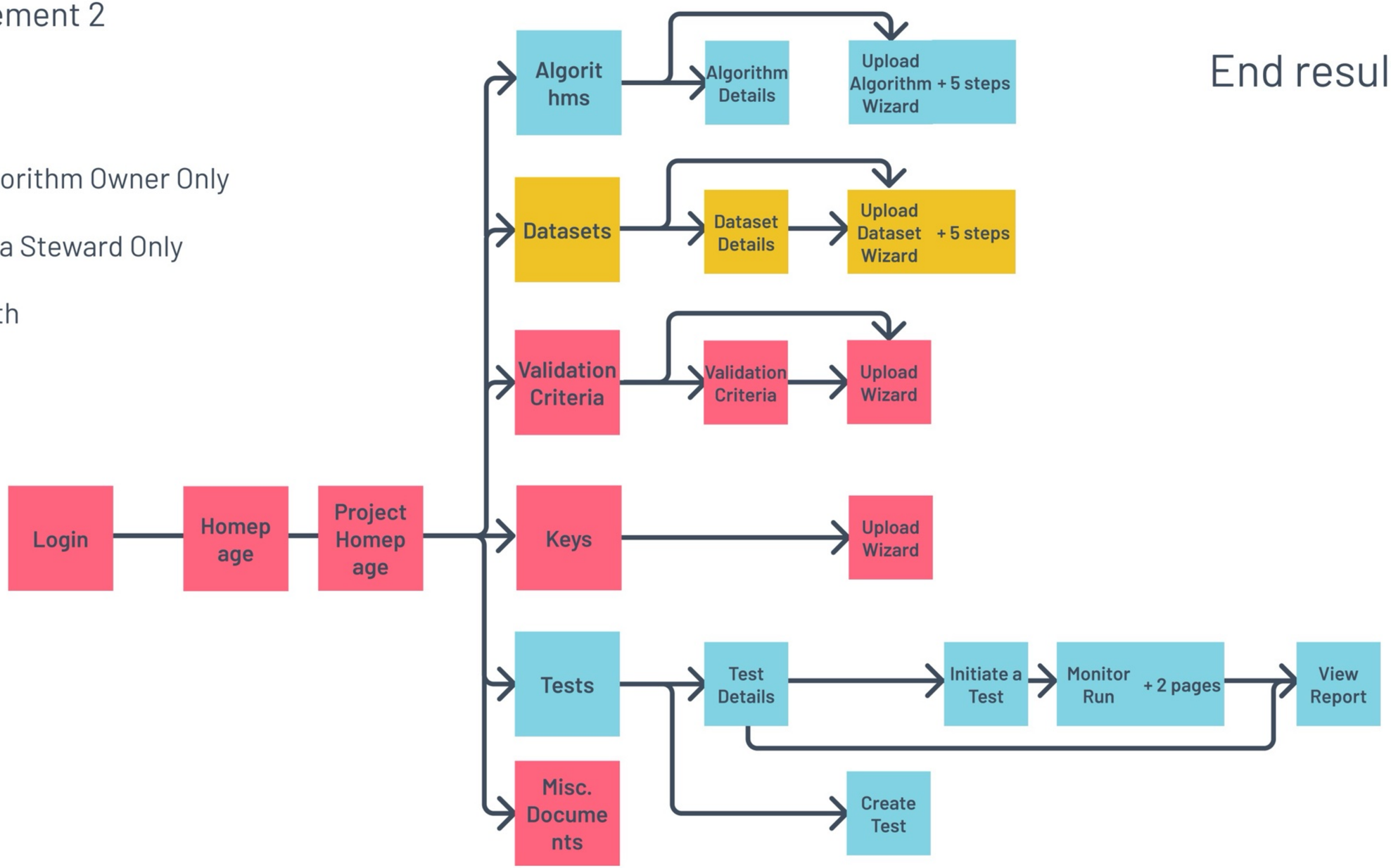
Engagement 2

MVP

Algorithm Owner Only

Data Steward Only

Both

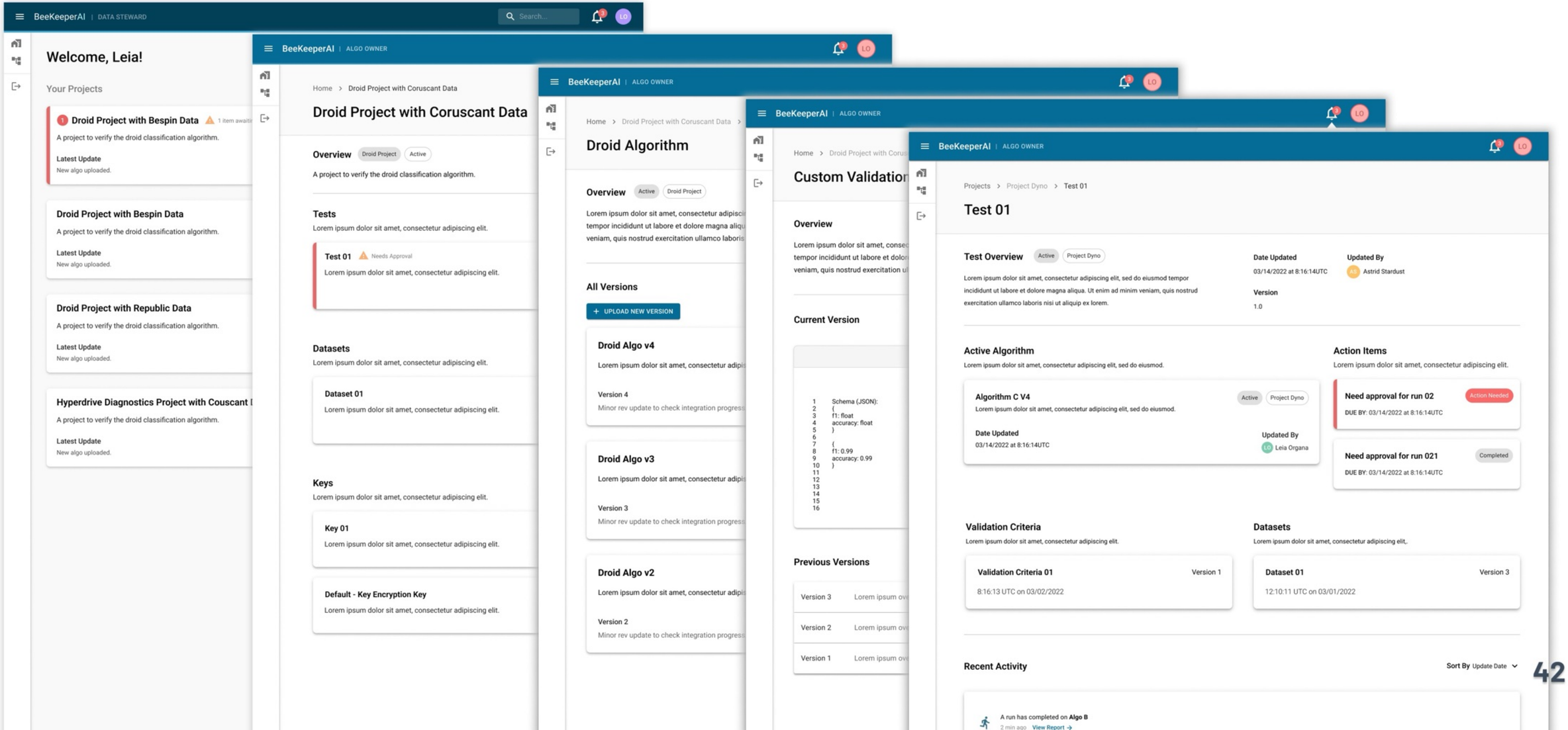


End result

Engagement 2

MVP

End result



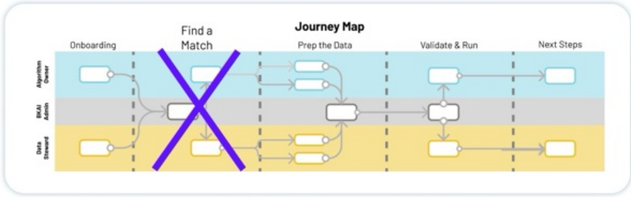
Engagement 2

MVP

START: The Case for EscrowAI

Funding & customer-finding was a great success!

We find out that customers don't actually need help matching. Instead, they want to **import their existing contracts & perform the run in BKAI.**



EscrowAI MVP – **Requirements & Sitemap Process Map**

How do we conceptualize the actual MVP product in preparation for the upcoming 3-month UI development build?

1. Planning

1. ID Key Clients

First of all, who were we building the EscrowAI MVP for?

BKAI's main focus is on **3 key clients** (bio-pharma clients) who were ready to run algorithms ASAP.

2. Plan sprints

I have 3 months to design everything before development starts.

How do I divide up the weeks into **design sprints** to get everything done?

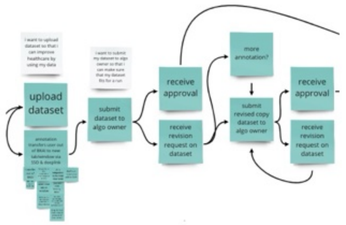
Engagement 2

MVP

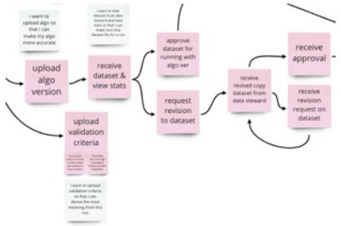
3. Workflow Mapping Features

I broke out portions of the key features into workflows and spent a lot of time with the architect & client Product Owners to fill in gaps in product knowledge.

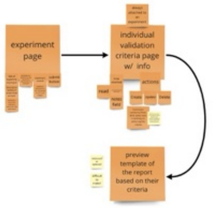
Dataset Upload & Review - Data Steward side



Algo Upload & Dataset Review - Algo Owner side



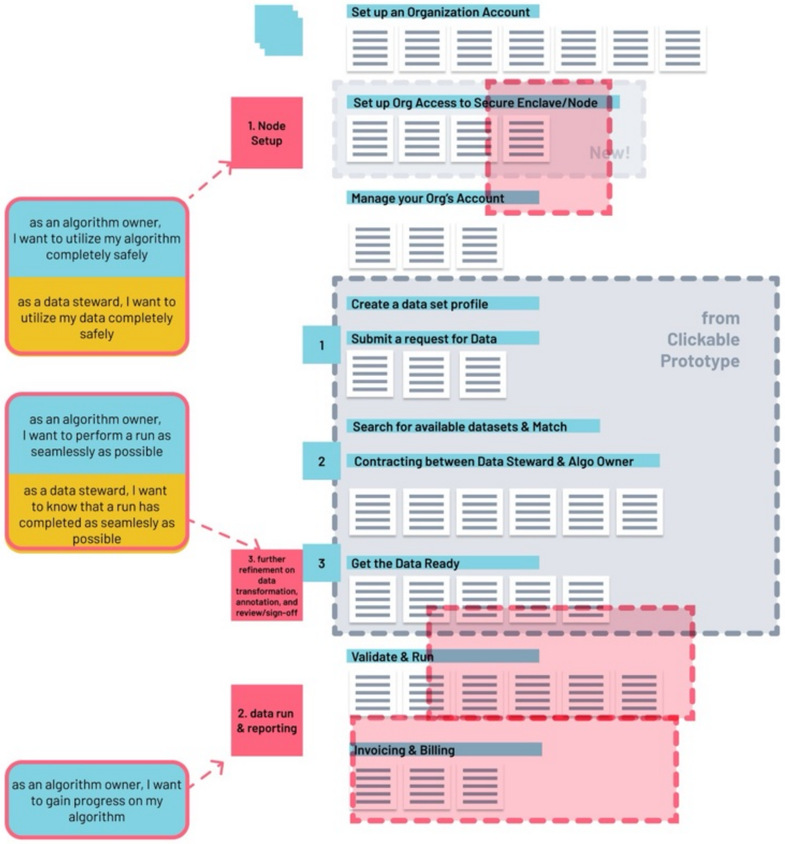
Validation Criteria



Initiate a Run

2. Confirm Key Features & Use Cases

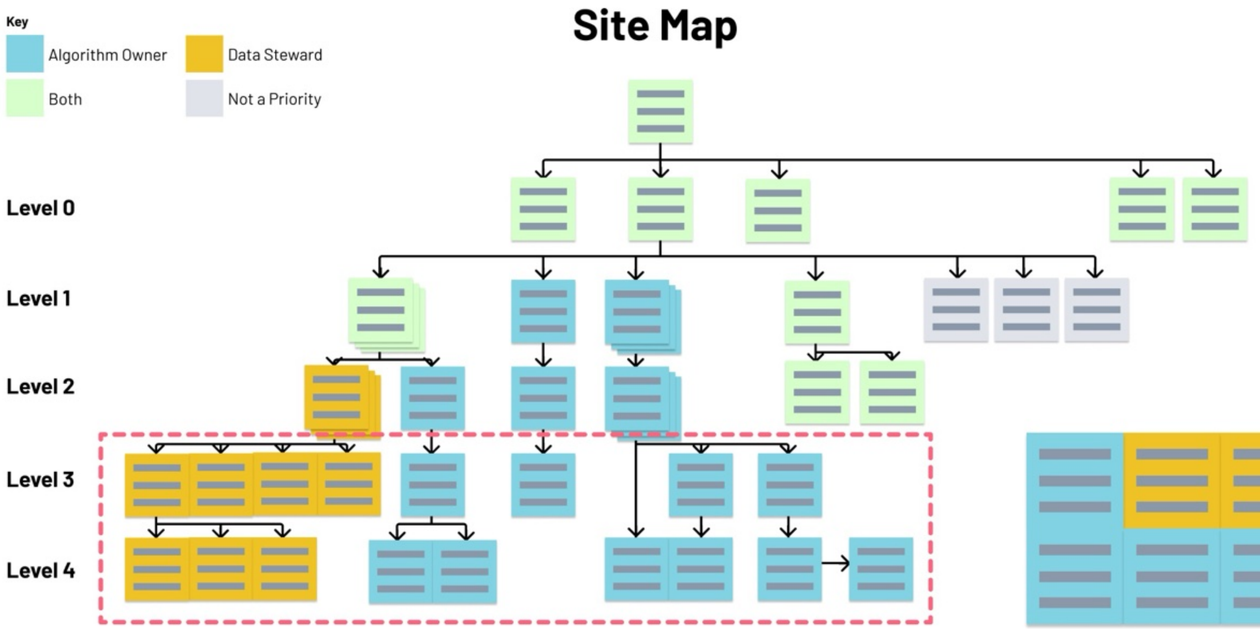
Now that I had information on key clients and use cases, I needed the client's help to pin down the highest-priority feature groups.



MVP

4. Site Map & Workshop

Now that all the steps have been unfurled, how do I figure out which specific ones I should concentrate on building out? Enter the **Site Map**.



I laid out all of the pages into a structure which is based off of the configuration of the prototype's information architecture.

I noticed that the most important functionality lies in the **bottom 2 levels** of this site map.

I randomized them and ran a **workshop** with the client Product Owners to figure out which specific pages have the most value vs. effort.

MVP

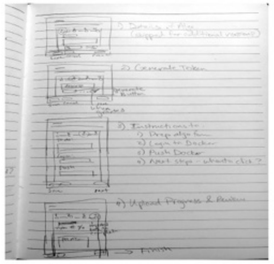
5. Low-Fidelity Wireframes

I have a shortlist of steps, so now I know exactly what pages & processes I need to prototype.

Napkin Sketch

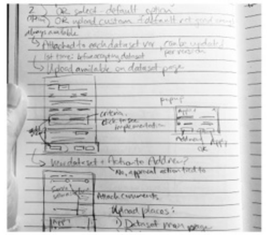
Low-Fidelity Wireframes + revision notes & questions

Upload Algorithm



Algorithm Upload (by the Algorithm Owner

Upload Data Profile



Data Profile

Validation Criteria

Example Data Set

Initiate a Run

V2 Experiment -> Test -> Initiate Run — Lisa Ver

MVP

6. Usability Testing

I developed a usability test for each persona to test understanding of the prototype.

I compiled my findings so I knew what revisions to make to the wireframes.

Algorithm Owner (3)
Hierarchy & Main Page, Algorithm Upload, Initiate a Run

- Most users are data scientists and are not specialized in Azure/enclaves
- '% Missing Data' is an important data point when viewing stats about a dataset
- Agree that a project is defined as 1 data steward x 1 algorithm owner

Data Steward (3)
Dataset Upload/Viewing/Approval, Hierarchy & Main Page, Reporting

- Need differentiation between role permissions, ex. a technical IT person vs. summer intern
- Very wary about the algo owner seeing anything about their dataset
- Experimental project vs. production project have very different needs

Part 2.5

Engagement 2: MVP

Design

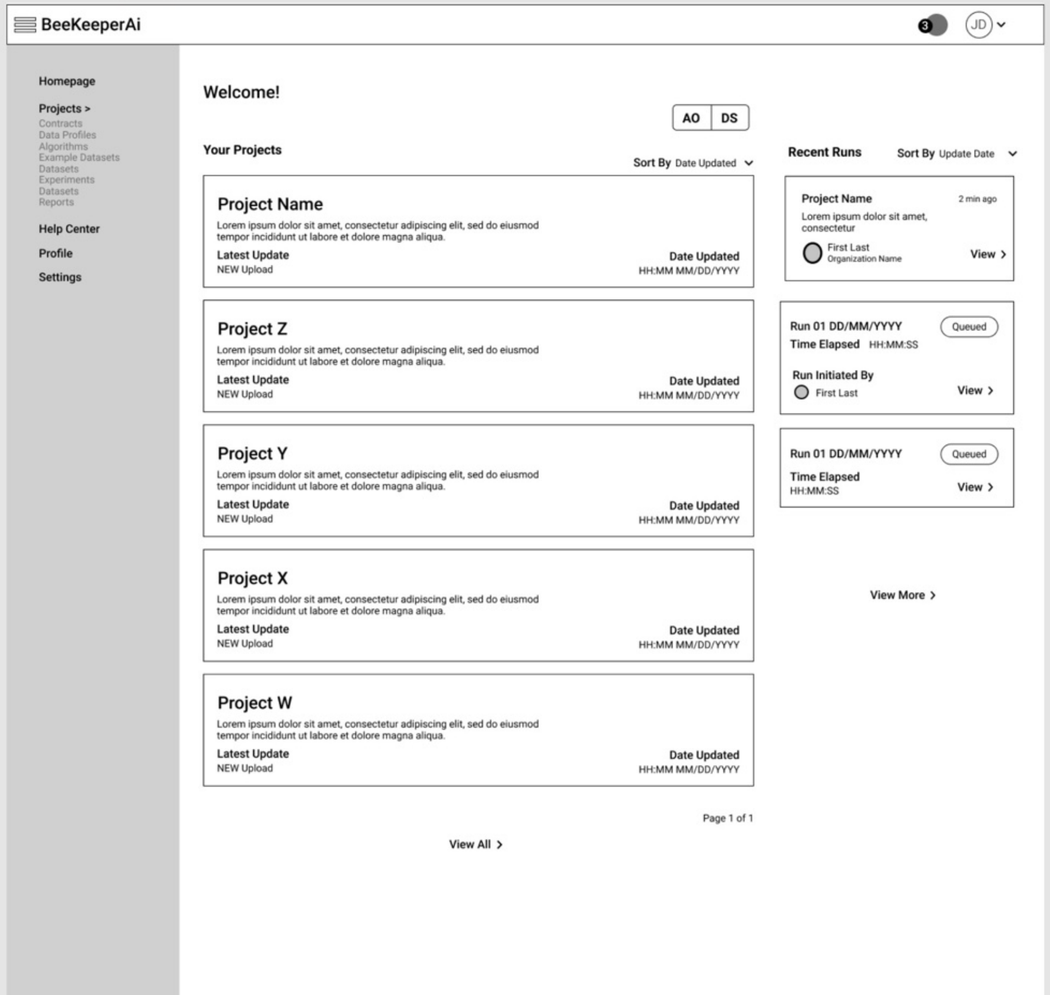
Sitemap of Features
Low Fidelity -> High Fidelity (x3 features) Designs
Documentation/Handoff
Conclusion

Engagement 2

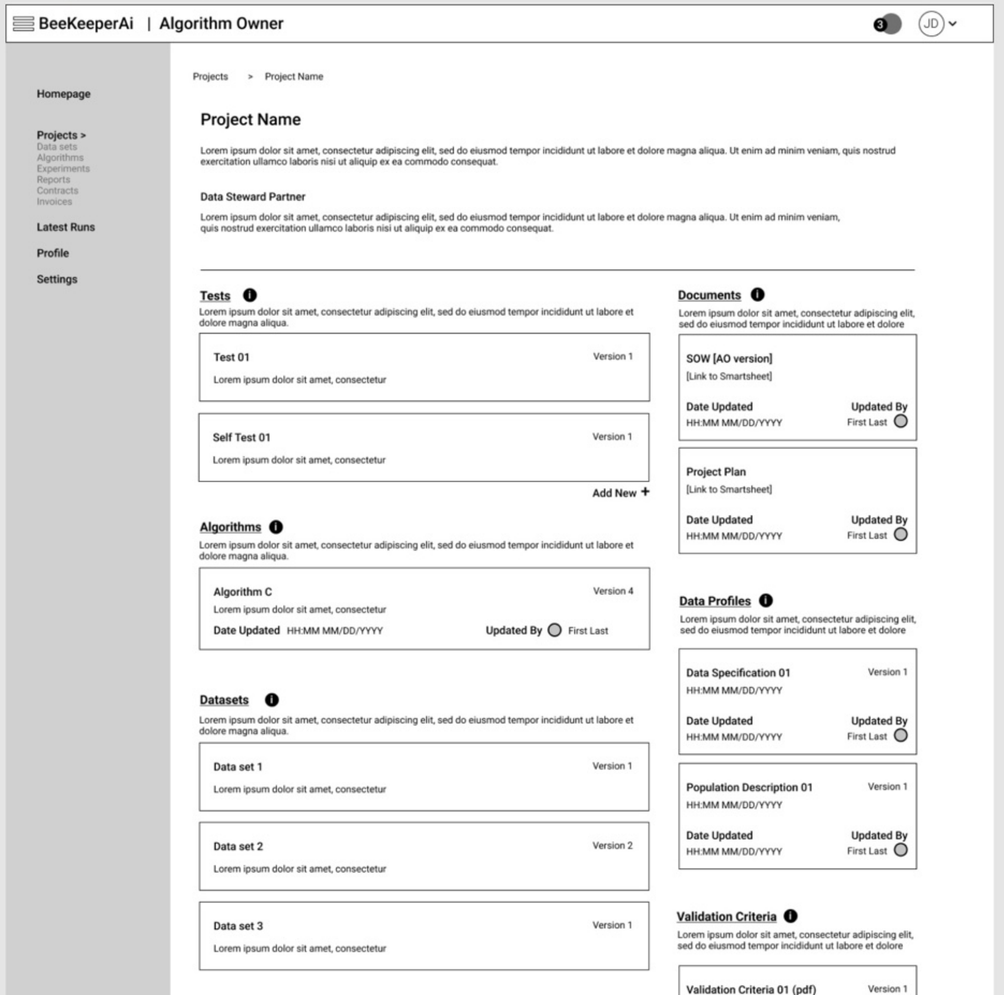
MVP

Low-Fidelity

Homepage



Project Page

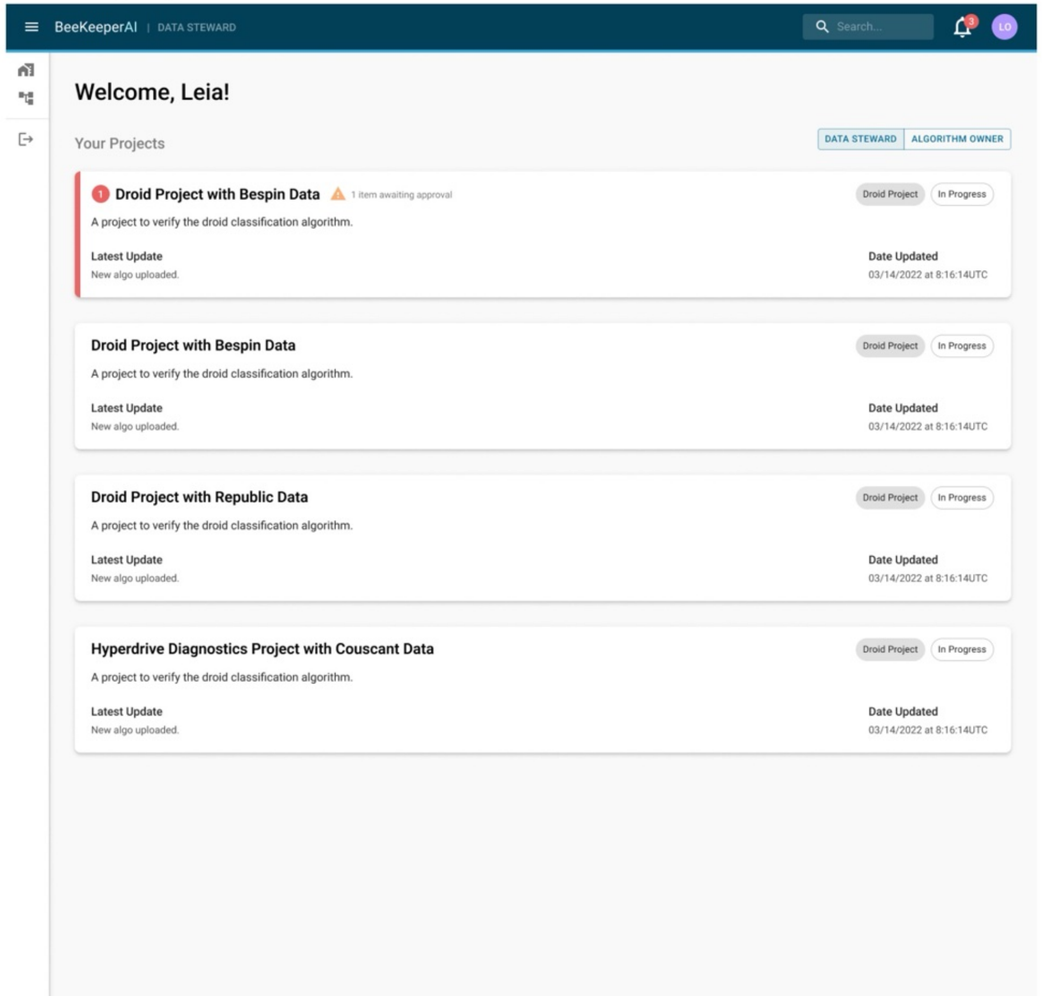


Engagement 2

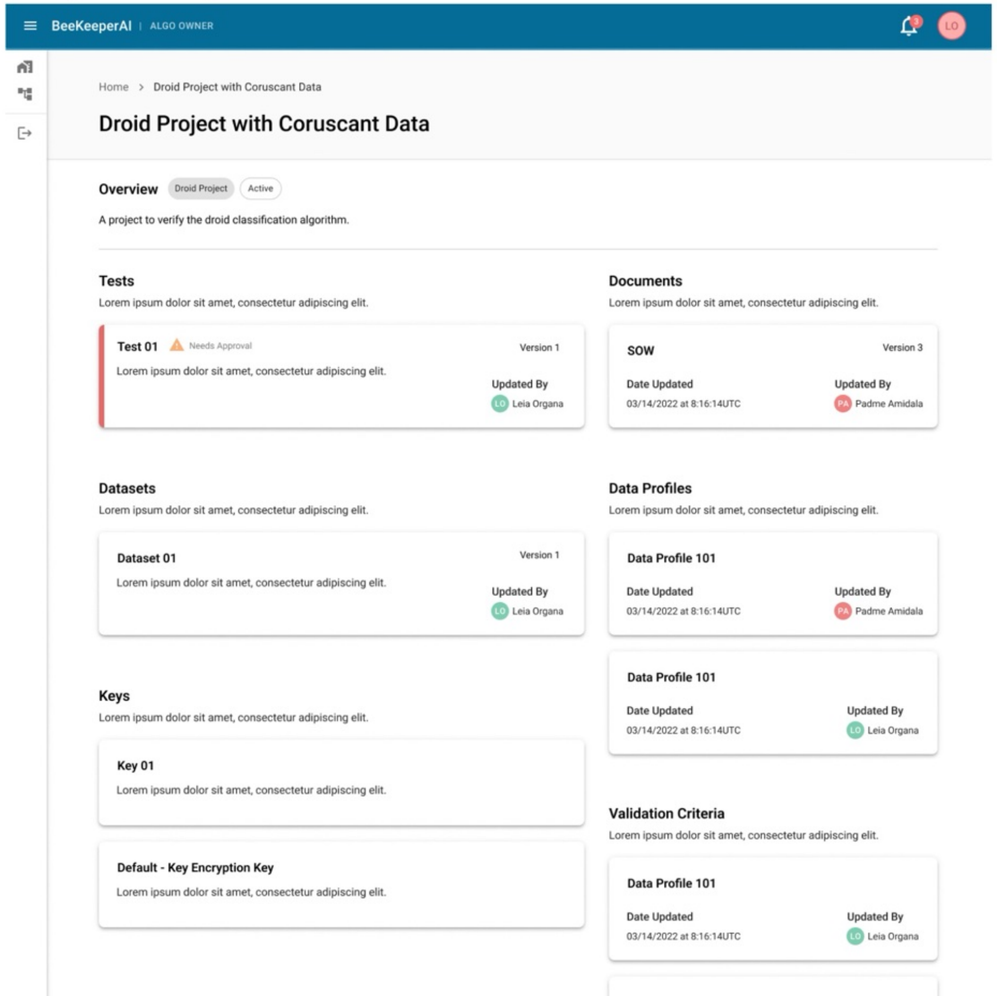
MVP

Mid/High-Fidelity

Homepage



Project Page

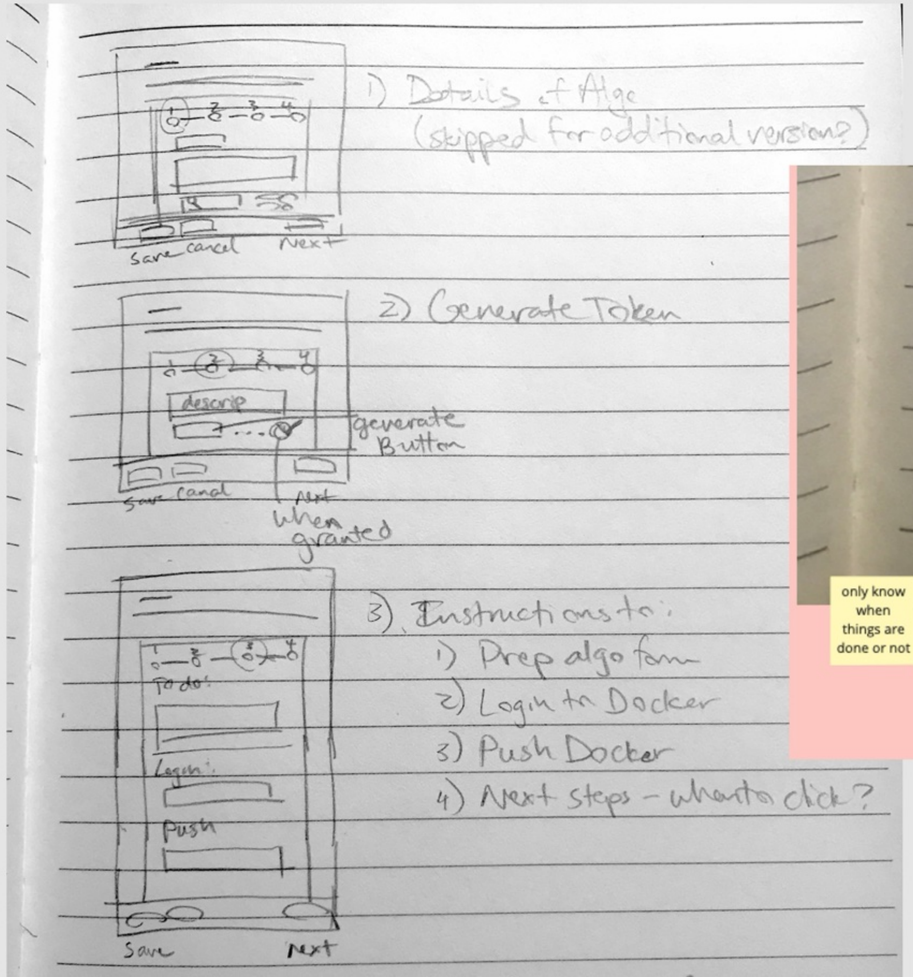


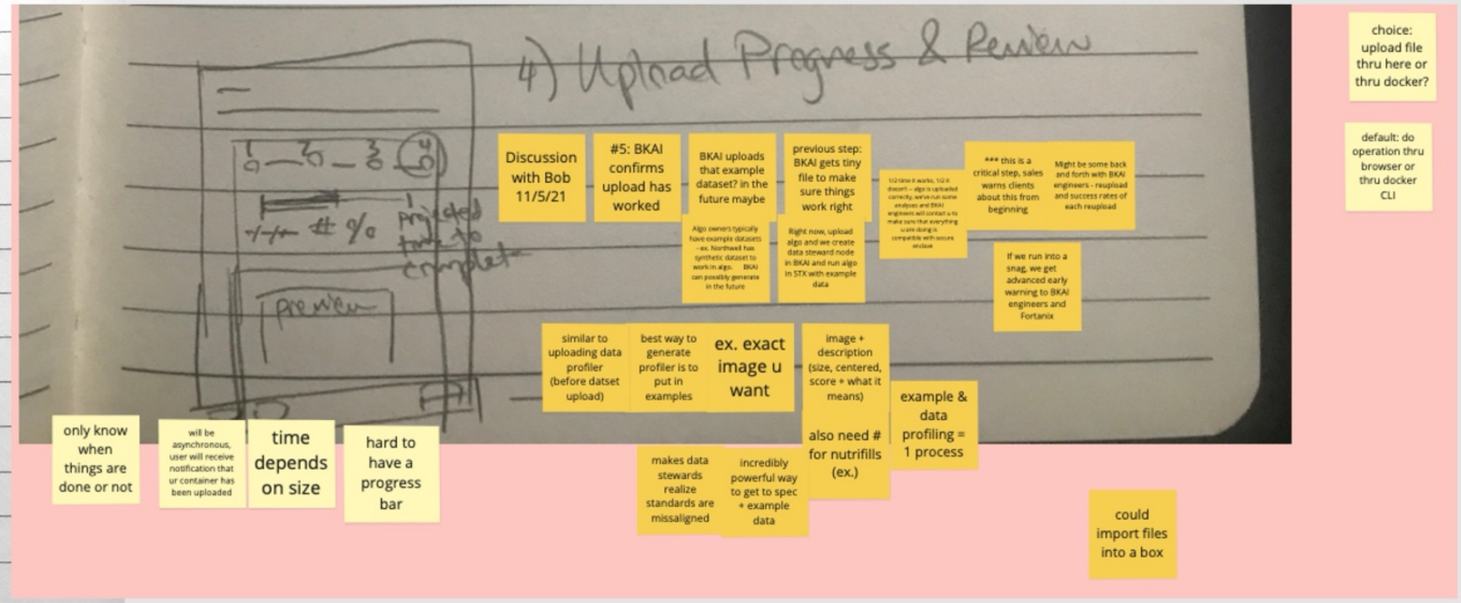
Engagement 2

MVP

Low-Fidelity

Algorithm Upload



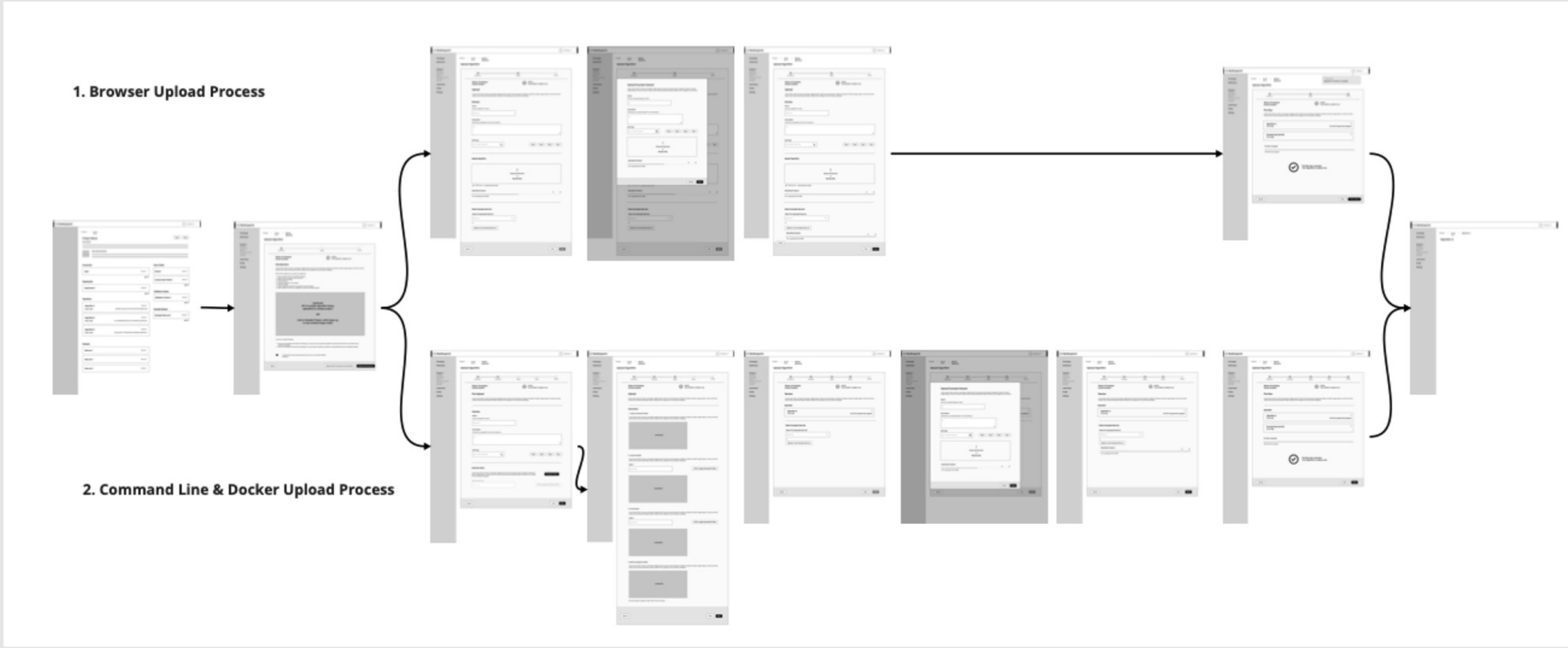


Engagement 2

MVP

Low-Fidelity

Algorithm Upload

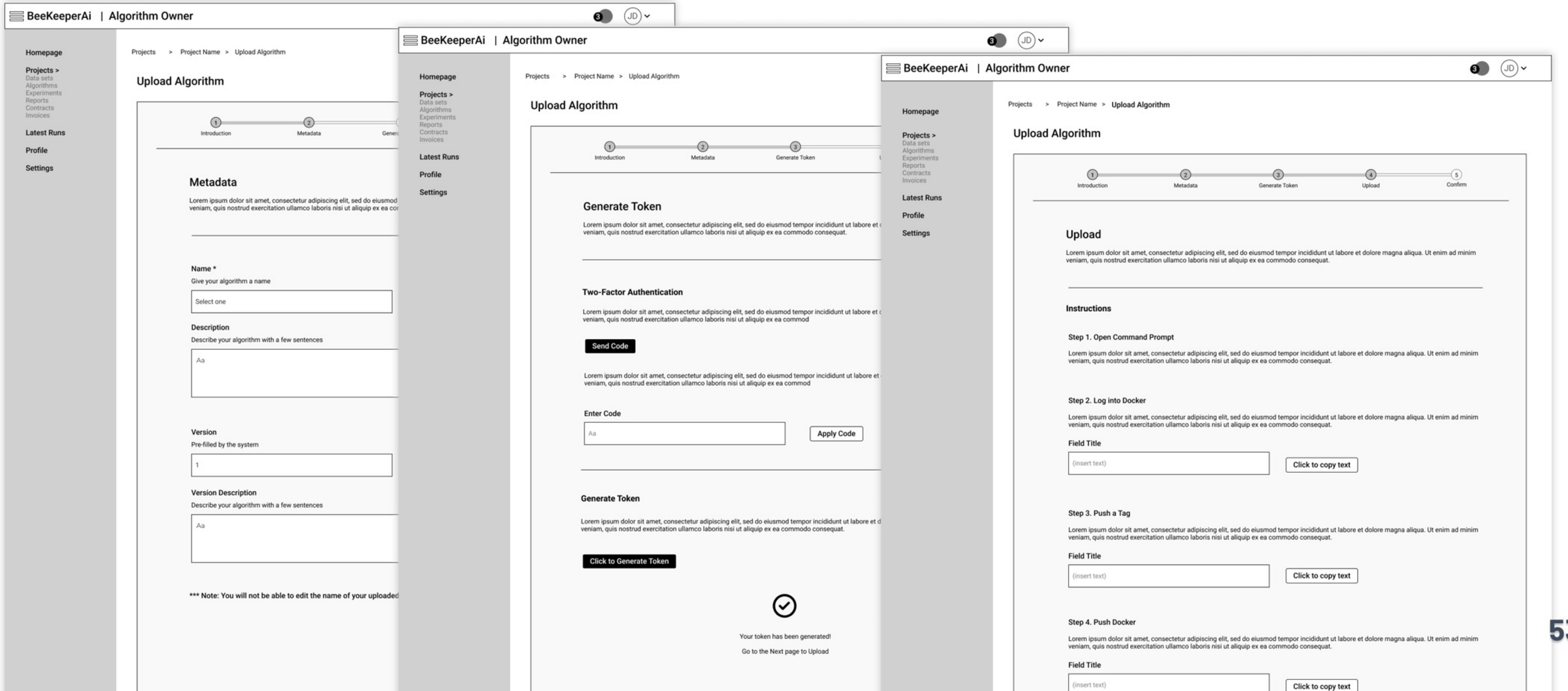


Engagement 2

MVP

Mid/High-Fidelity

Algorithm Upload



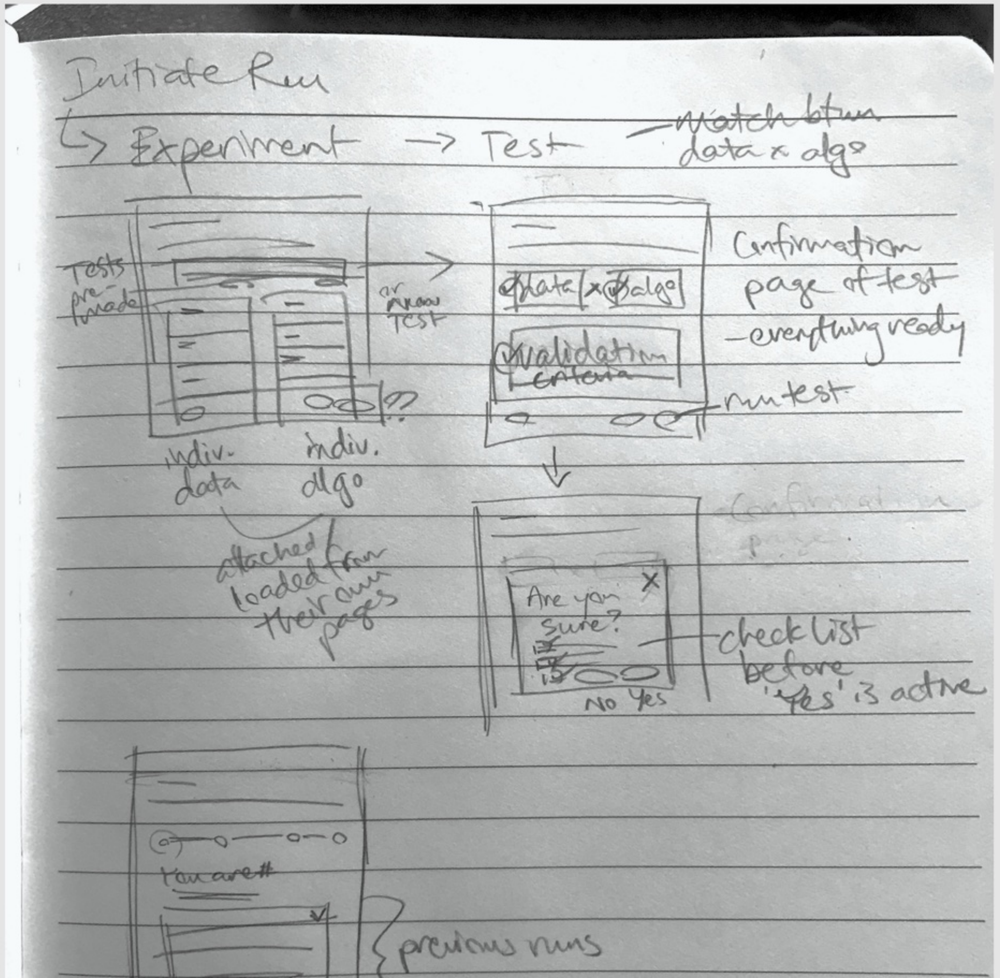
Engagement 2

MVP

Low-Fidelity

Create a Test

Initiate a Run

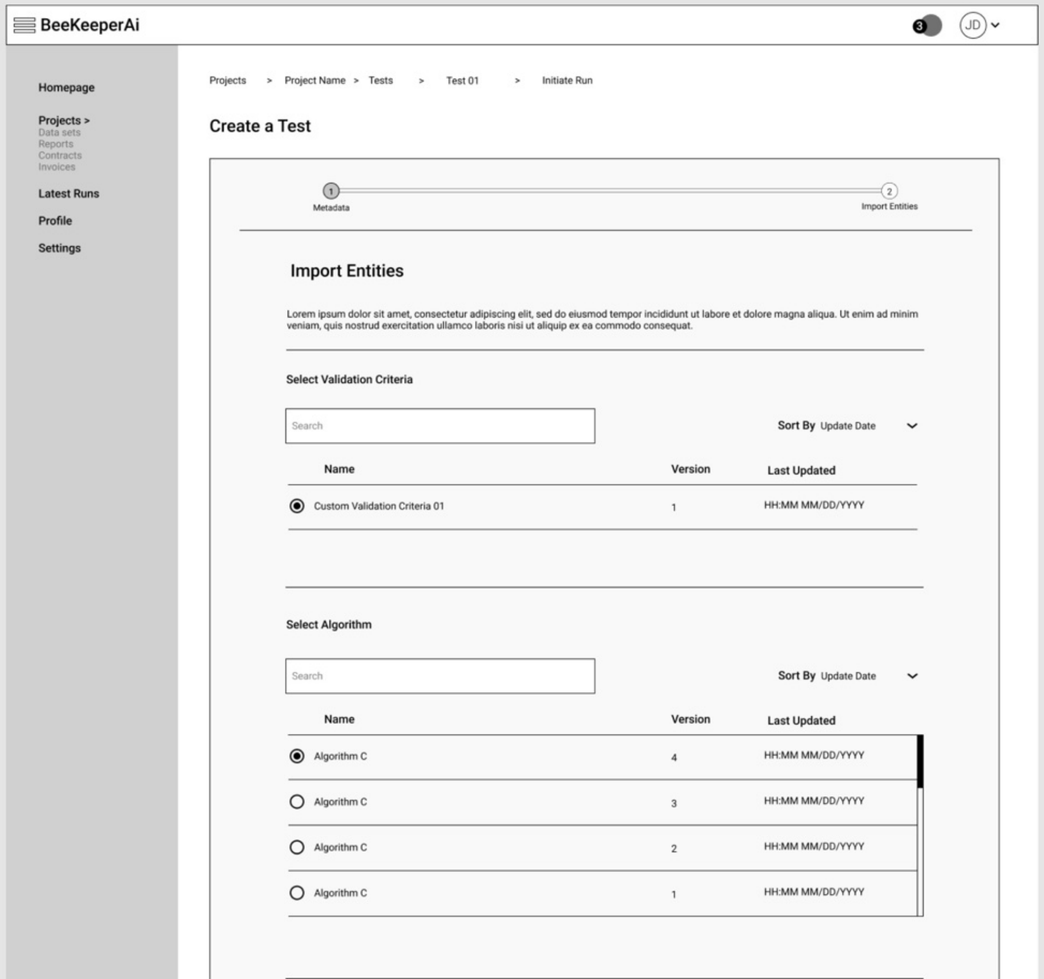


Engagement 2

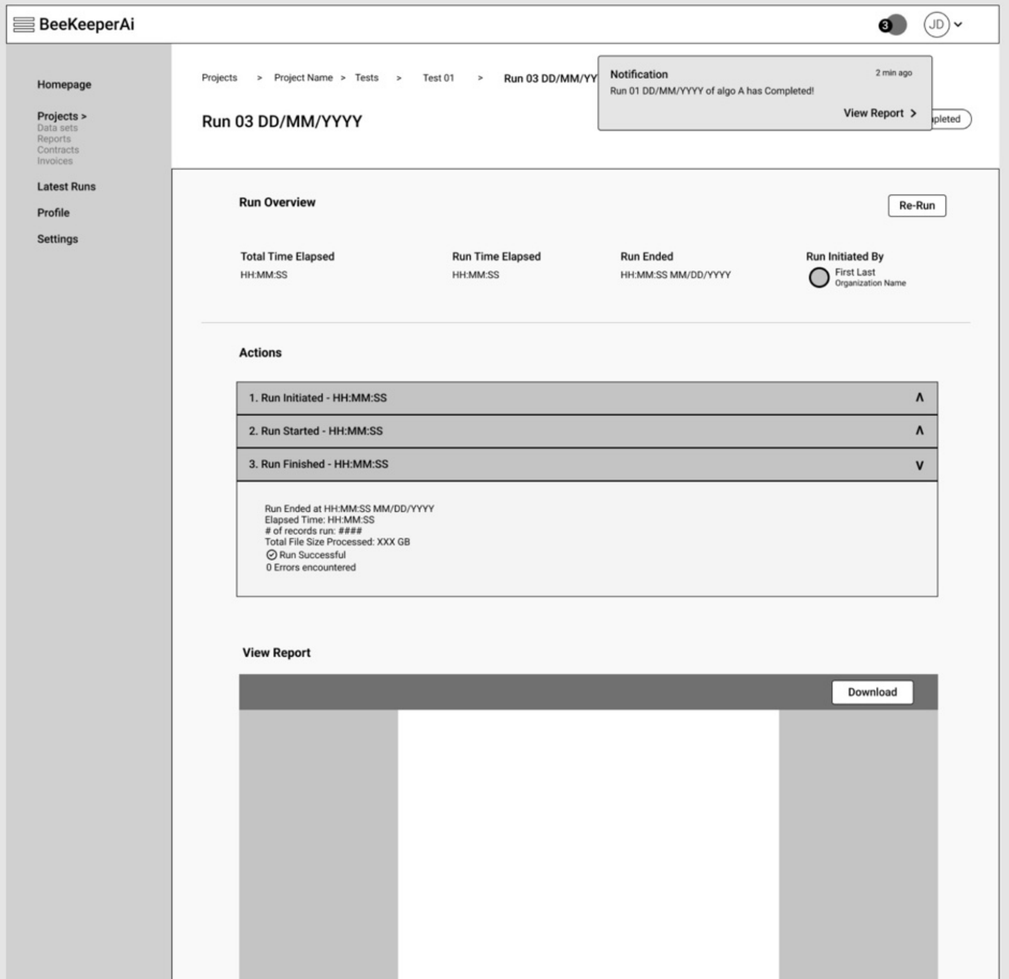
MVP

Low-Fidelity

Create a Test



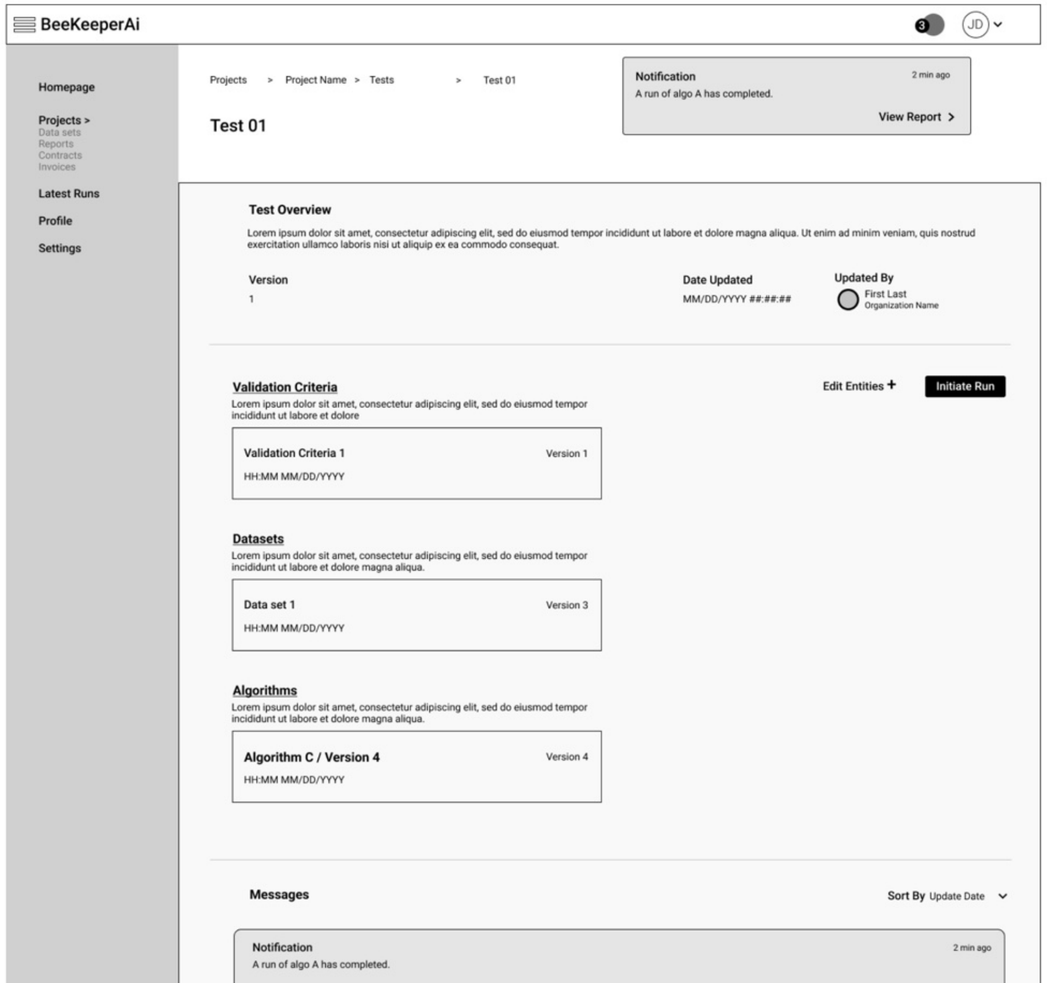
Initiate a Run



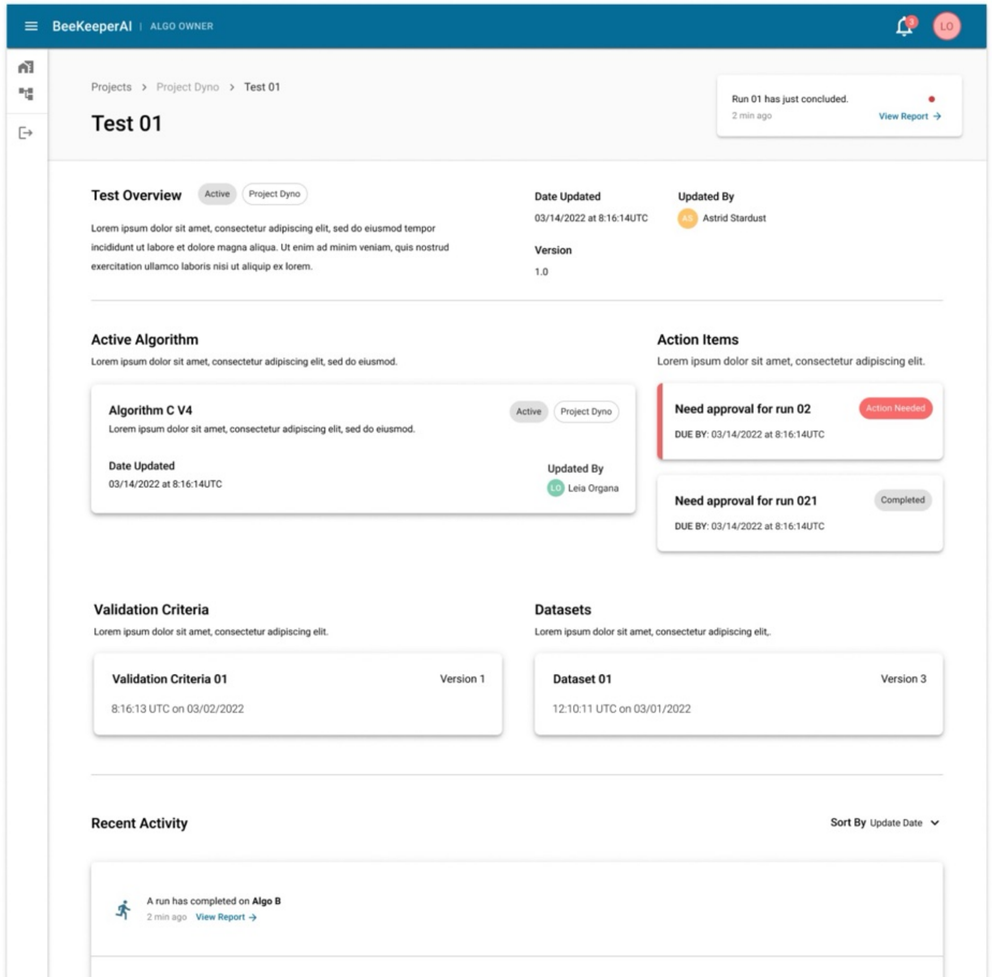
Engagement 2

MVP

Test Page - Low-Fidelity



Test Page - High Fidelity



Engagement 2

MVP

7. Research Design Kits

I mapped out the specific UI elements needed and noticed that BKAI had no need for custom UI elements. To save time, we should use an **existing UI kit.**

Standard	UI Kit #1	UI Kit #2	UI Kit
Size of User Base			
Has quality developer documentation?			
License Price			

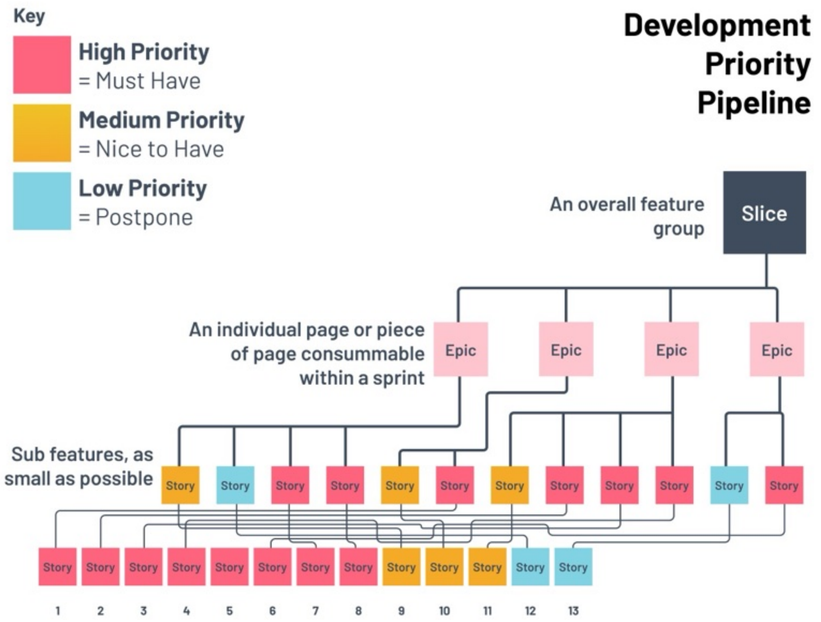
I assigned my junior designer to research which existing UI kit we could use based on these **standards**:

Collectively, we decided on **MUI.**

8. Slice Model for Jira

I developed this framework (alongside the development manager & the PM) and presented it to the whole BKAI team to help the client Product Owners **prioritize different-sized pieces of functionality.**

This marks the point where we begin UI development, and so we begin filling up the Jira backlog.



MVP

9. Sliced Site Map Workshops

I led **10+ requirements refinement workshops** with developers & client Product Owners in order to pin down exact priorities, feature dependencies, and important details.

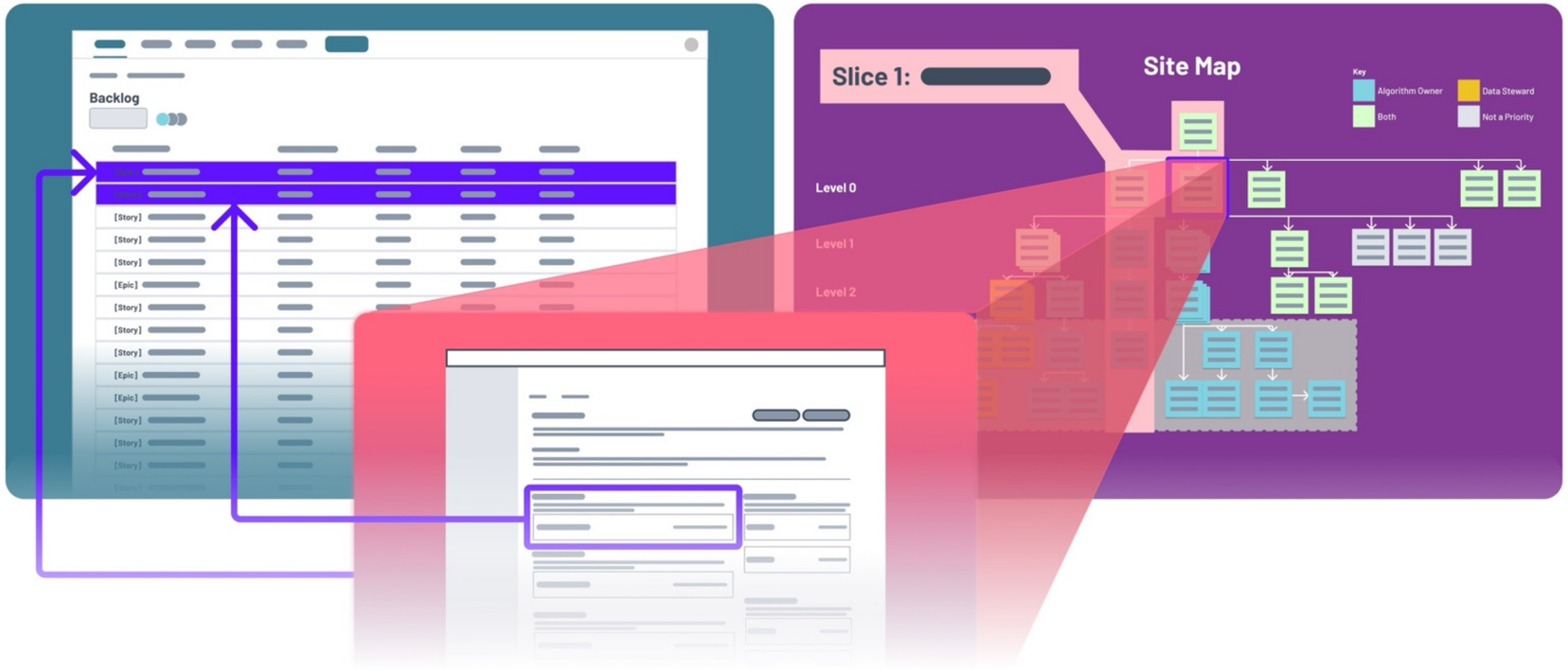
Slice — An overall feature group

Epic — An individual page or piece of page consummable within a sprint

Story — Sub features, as small as possible

In Jira		In Site Map
Slice	=	Path of Pages
Epic	=	Page
Story	=	Block of Page

Jira Backlog | **Sliced Site Map**



Engagement 2

MVP

11. Knowledge Transfer

As a core member of the project team, I took responsibility of documenting & transferring all of my **product knowledge.**

Work with client Product Owners & Developers to organize & publish Technical Documentation for users & developers

Leading Requirements Refinement workshops

Weekly meetings with client Product Owners, maintenance of artifacts

2X weekly UI office hours to answer developer questions

Weekly 1-on-1 meetings with Dev. Manager

Daily Syncs & knowledge transfer with Sr. Designer

1. Setup of the Technical Documentation space x 1

- Initial IA mapping of the future space
- Gather existing documentation from team channels & map to IA
- Work together with Product Owner to approve the IA framework
- Finalize publishing pipeline

2. Build the Individual Modules & Pages x # of modules

- Initial work: I populate & organize the page with existing material
- Technical writing: The developer fills any knowledge holes
- Proofreading: I work with the Product Owner to iterate revisions
- Approval: Product Owner signs off on the documentation
- Publish: Pipeline is activated, documentation

10. Divide UX Efforts

In the face of frequent dialogue & reprioritization during development, I implemented a **downstream-upstream approach** for subsequent UX work:

UX Design Lead, UX Researcher

Negotiate big feature changes, Low-Fidelity Wireframes, and work with PM & Development to organize the work in the Backlog

Downstream

Upstream

Senior UX Designer (part-time)

Perform design reviews on in-development pages, document high-fidelity MUI element usage

12. Beyond MVP

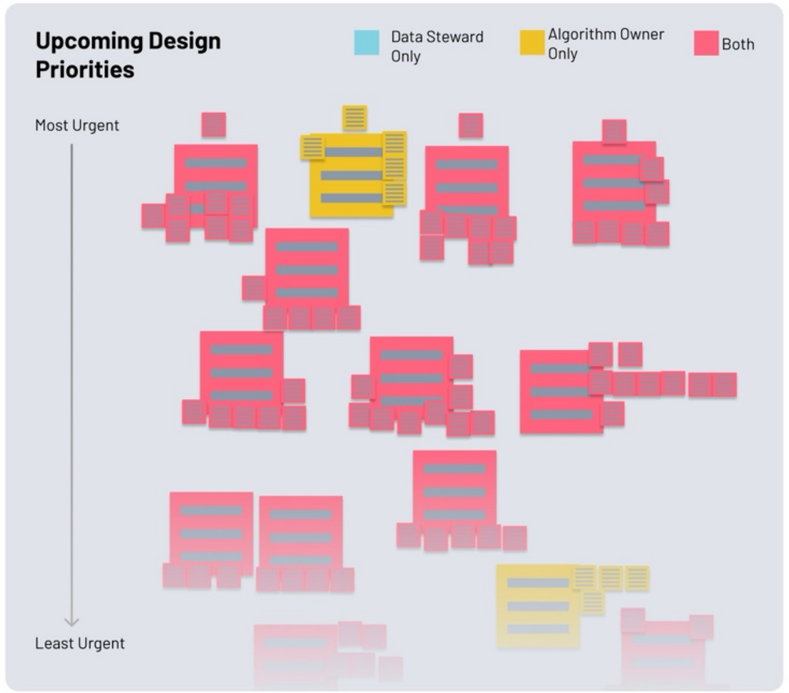
We've finished the major design initiatives necessary to launch the MVP — now what?

I gathered all the initiatives that were discussed but ultimately deprioritized for MVP. These included such efforts as:

- Solution-wide notifications
- Context-switching from a user's Data Steward view to their Algorithm Owner view & vice versa
- the BKAI Admin experience
- (and much more)

I consider these the next major design initiatives for V2.

I submitted this mapping to core project & client leadership to consider as the next set of features for design work for the next engagement.



Conclusion

The MVP is live!

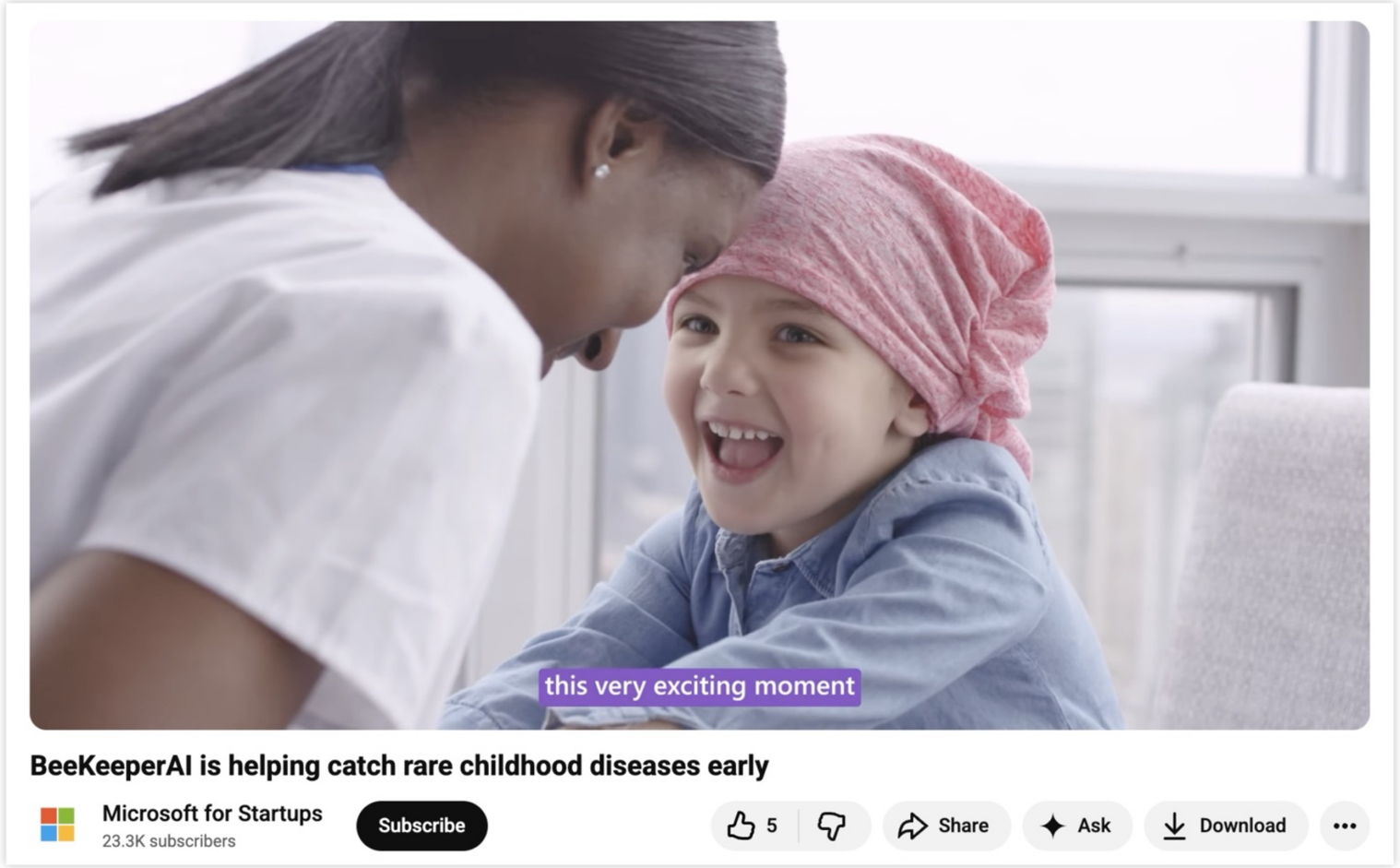
BeekeeperAI lives through its deepest and most important features & is currently listed on Azure Marketplace.

Engagement 2

MVP

As of April 2022, MVP “EscrowAI” is Live! Try it on Azure Marketplace here

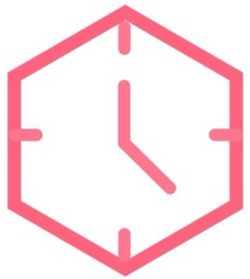
Latest publicity video here



Part 2.6

Impact

MVP is Live
High Visibility
Reduced Time/Money/Mistrust
What I Learned



Time

It takes approximately **5 years*** for a single clinical algorithm achieve generalizability.

12-24 months

Money

In the same vein, it costs an average **$5 million*** per algorithm.

$2.5-4M

Trust

Most significant is the mistrust between data owners and algorithm developers.

Zero Trust!
(and future marketplace)

*in the United States. In other countries, clinical algorithm development is often even more difficult.

The case of Doctor D & Algorithm A —

Doctor D

+

Algorithm A

=

More Accurate Diagnoses

For such conditions as:

- Breast Cancer
- Diabetic Retinopathy
- COVID (via chest X-Rays)

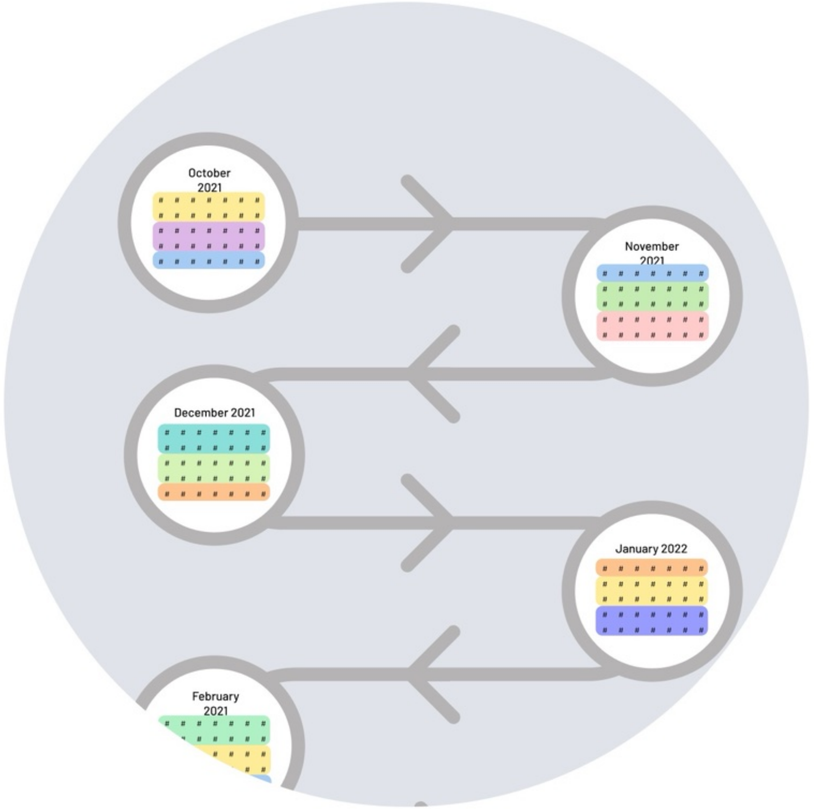
What did I Learn?

Take initiative! Have a specific roadmap & vision just for Design.

Design thinking is best applied sooner rather than later.

As lead designer, I don't have time to wait to take action until a product roadmap finally materializes. Instead, I build my own roadmap and form my own vision on the design side.

As I gather more information and progress in my journey, the entire product formation accelerates because I've pioneered a way forward. Everybody wins!

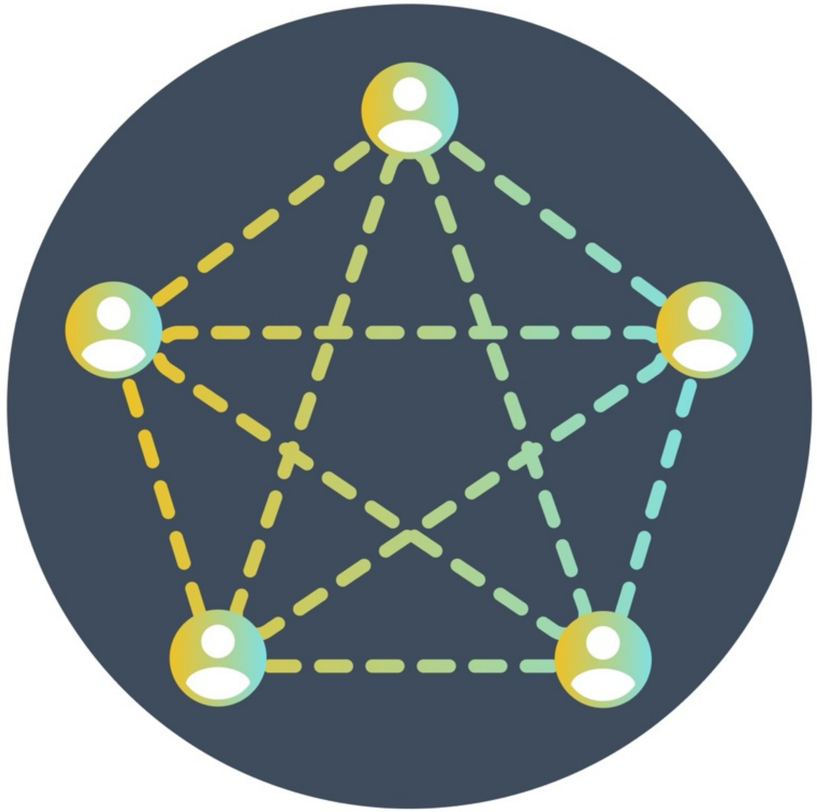


What did I Learn?

Your team members are your best resources.

My teammates and I create product magic between us because we both challenge & support each other by utilizing our complimentary skill sets.

There's amazing comfort in knowing exactly who to call when I'm stuck because I know that person is willing to whatever it takes to get me what I need.



What did I Learn?

Don’t stop searching for the truth.

I’ve learned that if I don’t understand something, it usually means other people don’t understand either. I will (nicely) ask until I arrive at a satisfactory level of detail or I know precisely who/where to target next.

The product will suffer if team members lack the clarity to do their jobs properly. It’s always, always worth the extra time & resources to ask questions even if it means feeling a bit silly in the moment.

End

For more projects, check out
lisanianliu.framer.ai