TEAM
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AMAZON LOGISTICS DIGITAL TWIN

ABOUT OUR SPONSOR

David Leonardo

David has been in the Last Mile Design Team at Amazon for 3 years. In his role as a Product Owner, David leads the development of the Design team’s suite-of-tools for site design, data capture, management, and dashboarding. Outside of work, David is an avid sports fan and enjoys playing basketball, golfing, and biking in his free time.

PROJECT OVERVIEW

The Last Mile Design team from Amazon owns warehouse designs for Delivery Stations (DS) across the USA and Canada. The design for each DS covers a wide range of attributes which are now stored and managed in AWS S3, while the actual designs are generated through CAD tools and stored within BIM360. The gaps between the physical designs and virtual attributes directly impact the productivity in each DS for both the Design Team and stakeholders (e.g. warehouse operations). The Last Mile Design Team is pursuing the creation of a “Digital Twin” tool, where the physical designs and virtual attributes can be paired and managed in a consistent manner to enable further engineering analysis.

Design Drawings generated through CAD tools, input from BIM360

Site Attributes saved as CSV, stored in AWS S3

Project Milestone are tracked in Redshift

Our Mission

We are developing a "Digital Twin" application designed to offer a **user-friendly interface** that ensures a seamless user experience. This application is supported by a **robust data warehouse infrastructure** that facilitates efficient data ingestion, storage, and retrieval, enabling smooth operations and enhanced data accessibility.

amazon
Digital Twin

TARGET USERS

Site-level Employees

With the new digital twin tool, site-level employees will be able to access their latest design details and drawings. They can propose site-level updates to their layouts which can improve their operations.

Program Owners

Program owners are looking to access the feasibility of new equipment which they would like to rollout to site's meeting a certain design criteria. They can leverage the tool to query critical design information and pull in design drawing for proposals.

Senior Leaders

Senior leaders will seamlessly access the latest design detail for a site during key leadership reviews or while visiting sites. This tool will improve their understanding of the site's operation and can drive key top-down projects on site improvements.

OUR APPROACH

PHASE 01
Understand User Needs

In the initial stage of the project, we held weekly meetings with our project sponsor to gain a thorough understanding of their current state processes and future state expectations. These meetings provided valuable insights into the key pain points the Last Mile Design Team is experiencing with their existing system.

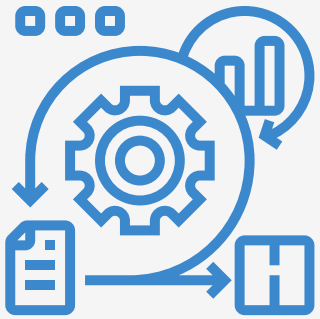
To further refine our project ideas and ensure we capture the full scope of user needs, we conducted a series of user interviews with various team members. This allowed us to gather diverse perspectives on the challenges and requirements from the viewpoint of different roles within the Last Mile Design Team. The combination of sponsor meetings and user interviews has enabled us to:

- Clarify the problem statement and project goals
- Gather and analyze feedback from key stakeholders
- Align our project ideas with the overall vision and strategy

PHASE 02
Wireframe Design

**Detailed information are removed for confidentiality*

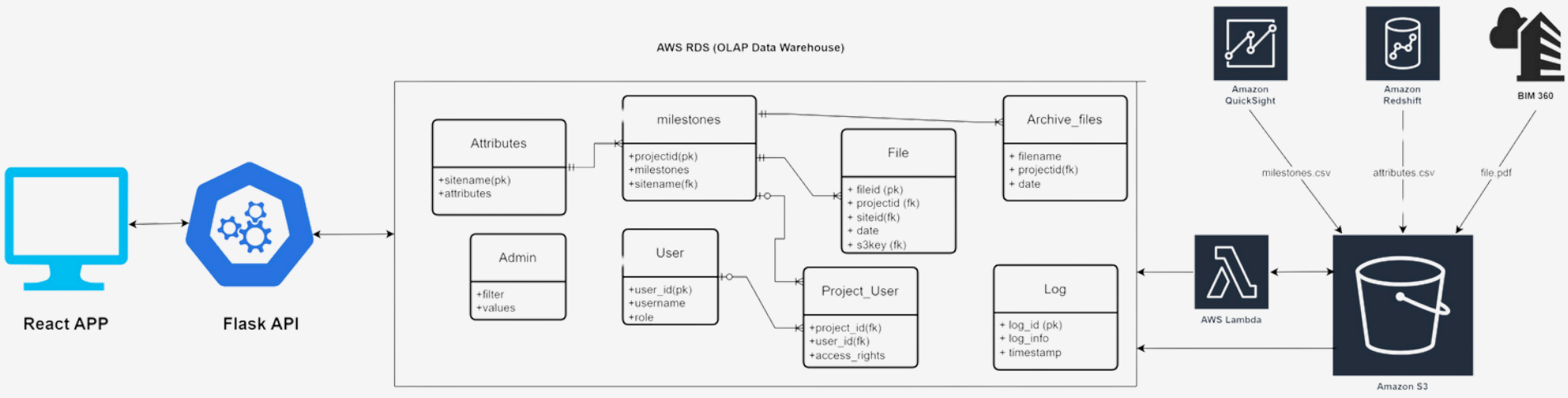
Our UX designer initiated the design process by creating low-fidelity sketches, which were iteratively refined based on insights from sponsor meetings and user interviews. The designer then used Figma to create high-fidelity wireframes and visual designs, incorporating feedback to enhance clarity, usability, and user experience. The final step involved developing an interactive prototype in Figma to provide stakeholders with an immersive experience of the Digital Twin solution post-implementation.



PHASE 03
ETL and Data Warehouse

For data warehouse construction, we have engineered two Lambda functions to streamline our operations.

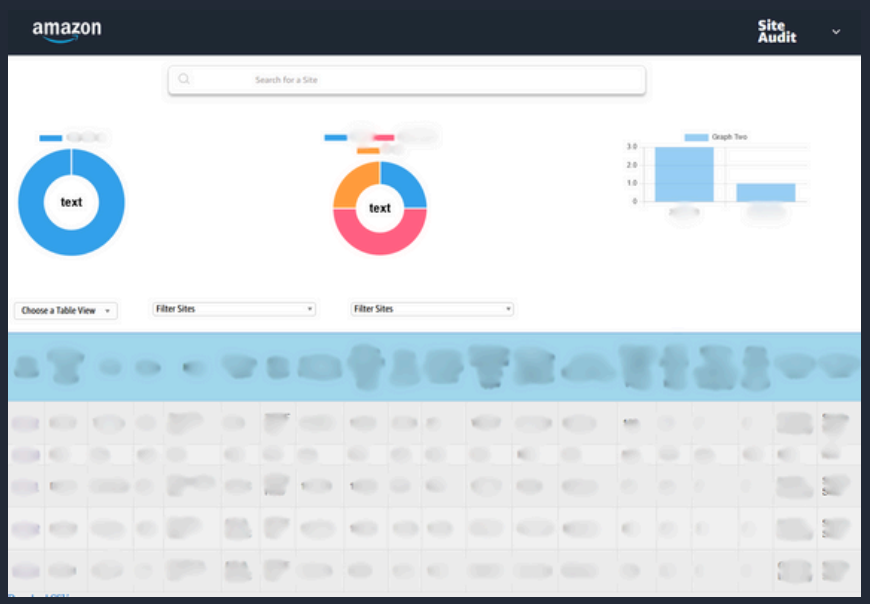
1. The first Lambda function meticulously populates our milestones and attributes tables, ensuring accurate data representation.
2. The second Lambda function plays a pivotal role in file management, extracting file names and orchestrating file archiving processes. Notably, this function executes an annual archival routine, ensuring files older than a year are appropriately stored. Furthermore, it maintains a judicious approach to file retention, preserving a single copy of each site, even if files surpass the 2-year mark. By implementing these strategies, we aim to uphold system integrity while optimizing efficiency in our data management practices.

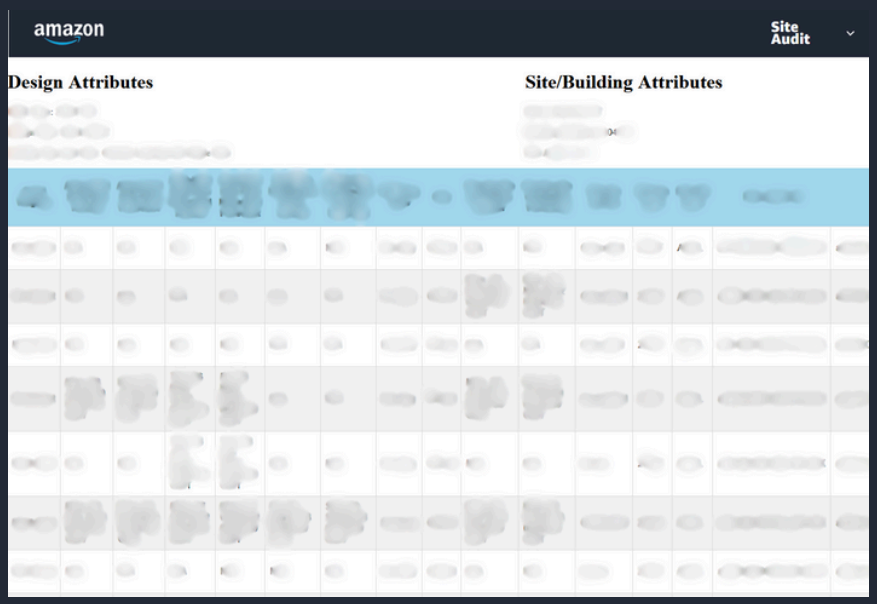


PHASE 04
Application Development

The back-end of the application is built in Flask and the front-end utilizes React paired with JavaScript to render webpages. The application is connected with AWS to fetch data from S3 and databases created in Relational Database Service (RDS). The application consists of 3 main pages:

1. Home Page
2. Site Specific Page
3. Projects Timeline Page





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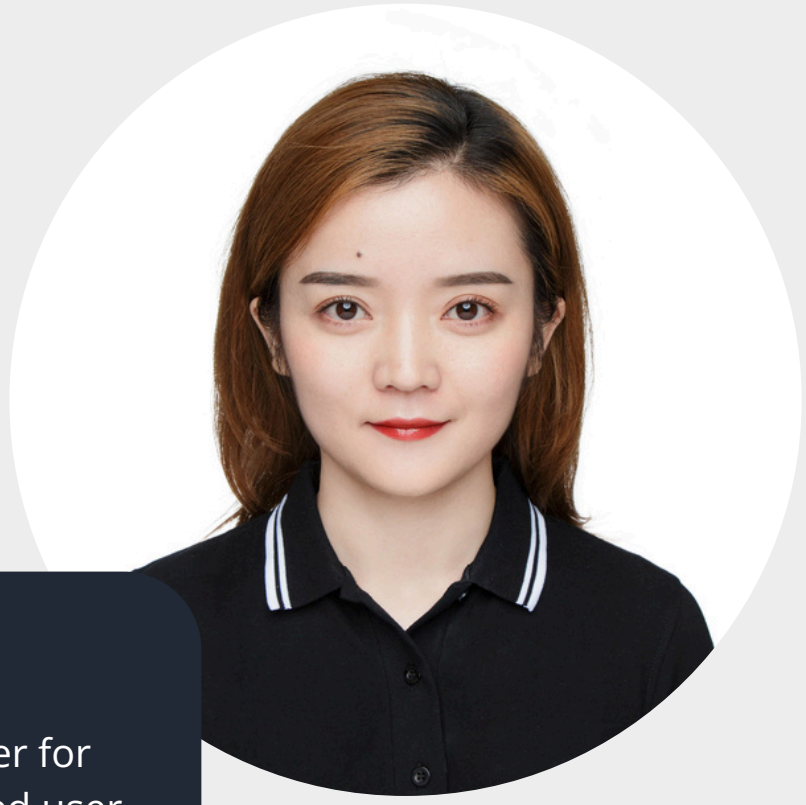
KEY BENEFITS

The application will **serve as the source-of-truth** for all attribute-related data and drawings for stakeholders. It will support **100% coverage** of the North American network with **an opportunity to scale** to the rest of the world (EU, Japan, Emerging Countries) for AMZL.

The application will drive a **more than 50% reduction in time spent** locating the latest artifacts and attributes. Allow users to **track updates** for drawings, modifications in attributes, and deliver **accurate results in a timely manner**.

The application, **developed on AWS,** provides the Last Mile Design team with **free access**. The development of the Digital Twin will result in **cost savings**, enabling the team to reduce the current average monthly token cost of $12,500.

The **improved file management** feature will align with project management and key milestones, and **improve productivity** for end-users.



QI DUAN

Product/Project Manager & UX Designer

Qi is the Project/Product Manager and UX Designer for this capstone project. In these roles, Qi has bridged user needs and project requirements into a cohesive product vision, leading the development of AMZL Digital Twin. Qi designed all wireframes and established the strategic direction for the product, ensuring it aligns with stakeholder expectations through effective communication. Outside of this project, Qi is passionate about yoga, which she practices regularly as part of her commitment to mindfulness and well-being.

DENZIL DSOUZA

Data Architect and Software Developer

Denzil operated in a dual capacity as a Data Architect and Software Developer. He meticulously analyzed project requirements, leading the architecture of an OLAP Data Warehouse to boost application efficiency. Additionally, he personally revamped file management processes and implemented automated archival systems to reduce the burden on the active database. Denzil spearheaded the entire backend infrastructure development on Flask, ensuring a robust foundation for the application's operations. Moreover, he created the entire ETL pipeline, orchestrating the seamless flow of data. Outside of his role, Denzil is an avid motor racing enthusiast and a dedicated Formula One fan.

Shobhit worked in a hybrid role as a Data Engineer and Software Engineer for the project. He developed, edited and finalized the scope of the project, and bridged user needs with technical feasibility to develop a real-world application as a proof-of-concept. He developed the APIs in Flask, conceptualized the SQL database schema collaborating with Denzil and built the front-end of the application in React, converting the wireframes to actual, workable and DRY code. Outside of class, Shobhit enjoys playing tennis, pool, hiking and reading fiction classics.

SHOBHIT VERMA

Data Engineer and Software Engineer

Shirsha serves as the Project Manager for the Last Mile delivery team at Amazon Logistics, where she efficiently manages timelines and deliverables using Jira, and regularly communicates progress through detailed reports to the project sponsor and supervising professor. Additionally, she has enhanced user experience by assisting in designing an interactive frontend in Figma and collaboratively creating a tailored admin portal, meeting specific needs in partnership with the sponsor. Beyond academics, Shirsha enjoys painting and listening to music.

SHIRSHA DATTA

Project Manager