Automotive Assisted Driving Data Catalog

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Case Study
at Glance

Scientists and engineers in the research arm of a global automotive company are developing motion planning, perception, and localization algorithms to enable autonomous driving technology.

This endeavor requires the creation of a large repository of annotated vehicle sensor data that can be used for the evaluation and training of machine learning algorithms which are instrumental in creating safe assisted driving systems.

Motion planning, perception, and localization enable the next generation of assisted and potentially autonomous driving technology.

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The Challenge

Scientists and engineers in the research departments distributed in three locations around the world required a mechanism to create, store and search large repositories of annotated vehicle sensor data.

Data is collected under various conditions using experimental vehicles which are instrumented with sensors such as cameras, LIDAR, radar, and GPS. Such data requires a sophisticated data management system to not only store and retrieve the data, but also visualize important attributes.

This data is highly heterogeneous in terms of format, size, source, and ways to process it. Scientists needed a single source of truth to store metadata and run rich and complex queries.

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The Solution

The proposed architecture to solve this challenging data and business problem included Carbon LDP that helped them to transform all of the sensor-collected data into visual models that provide meaningful insights.

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What Linked Data has to do with this solution?

These models and the managed data allow them to mark and annotate information to find patterns for further analysis, thus reducing the needed time to find relevant data, to create a repository library to identify already performed experiments globally, and to use Carbon LDP's API to identify hidden unmarked content in their databases.

The company decided to create a custom system that includes a front-end application (making the information available through a web interface) and a set of micro-services (using parallel computing) to help transform their sensor data into visual models that provide insight into emerging patterns under a variety of conditions.

Sensors are often added and removed throughout each testing scenario meaning the application and data model had to be flexible to accommodate rapid change. Having the flexibility to extend the data types and schemas were two of the most complex tasks facing the development team. The solution addressed the data model challenge by recommending a linked data platform in lieu of a traditional database approach.

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Regarding the UX/UI design

O nce the design was completed, it was clear that the solution required the use of modern web technologies and modern web browsers. The biggest challenge was finding a way to manage vast amounts of sensor data and then creating an application that would easily adapt to the wide variety of sensors being used by the research team.

Carbon LDP (Linked Data Platform) is an enterprise-class linked data platform allowing developers to create applications and easily extend them using linked data. Carbon LDP is built on top of Linked Data standards endorsed by the World Wide Web Consortium (W3C). Modern web development tools coupled with Carbon LDP enable the implementation of the solution.

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Features available in the first version of this system

User authentication using an enterprise-ready directory service.

Integration with external services for rendering maps with path displaying capabilities.

Integration with an external provider to transform MP4 videos into a web-ready and performant format.

User and groups management including permissions setting and accounts disabling methods.
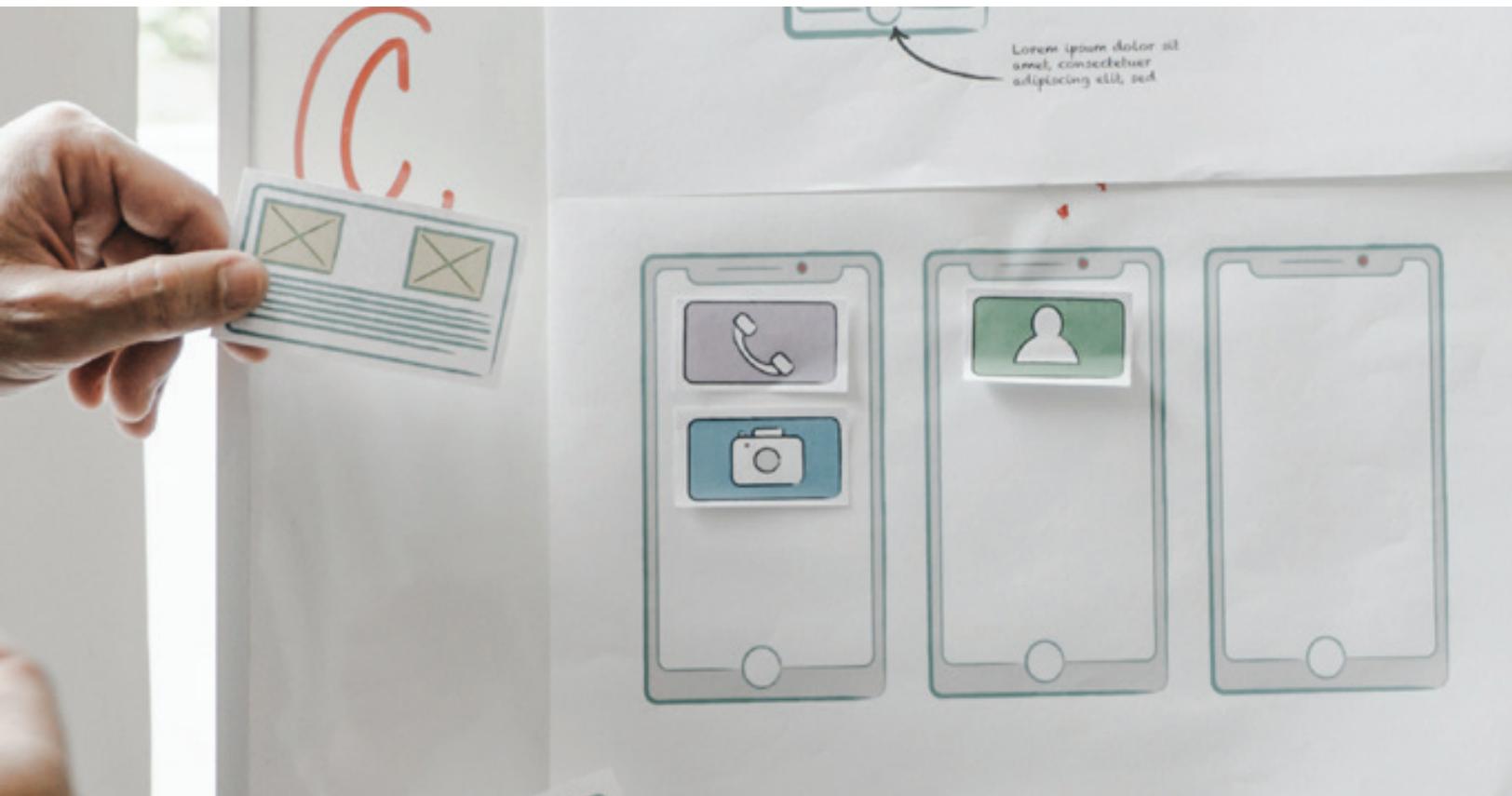
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Possibility to run custom queries using a query builder that creates a dynamic SPARQL-based query.

Multiple data models to represent sensors, recording platforms, categories, tags, recording sessions, clips, data sets and collections of images.

A job manager that is capable of using parallel computing to transform raw videos into MP4 format.

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The Results

The initial release went live with positive feedback from the research team.

This release serves as a tool for socializing scientists' research efforts with their automotive research colleagues in the USA, Europe, and Japan.

Scientists from three locations were registered and they have access to the initial data sets and recording sessions catalog.

There are two search modes: basic which allows looking for data using keywords and phrases with typeahead capabilities, and advanced search which uses a query builder that allows complex queries using a friendly user interface (scientists are not required to learn SPARQL in order to run rich queries).

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