Visualization using R to Support Scientific Research and Data Analysis

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Introduction

- Scientists utilize tools such as R for modeling, analysis, and expressing complex data of varying formats.
- There is a need for effective ways to express these research products so they can be communicated to various audiences, including sponsors, policy makers, and the broader community.
- This work explores the use of the Shiny package for R Studio as a means for integrating interactive visualizations directly with research products.
- Data from the Persistent Dynamics Project at Pacific Northwest National Laboratory was used to evaluate these capabilities.

Methods

- Packages in R provide a set of functions already programmed to meet an objective.
- We aimed to leverage these open-source software packages that implement visualization capabilities for R studio:.
  - Shiny
  - Shiny Dashboard
  - Plotly
- Then, we collaborated with domain and subject matter experts to develop visualizations to explain key findings from models under active development.
- Next, we built custom visualizations with interactive components to allow model output exploration.
- Lastly, we created a graphic user interface to collect and organize the various visualizations.
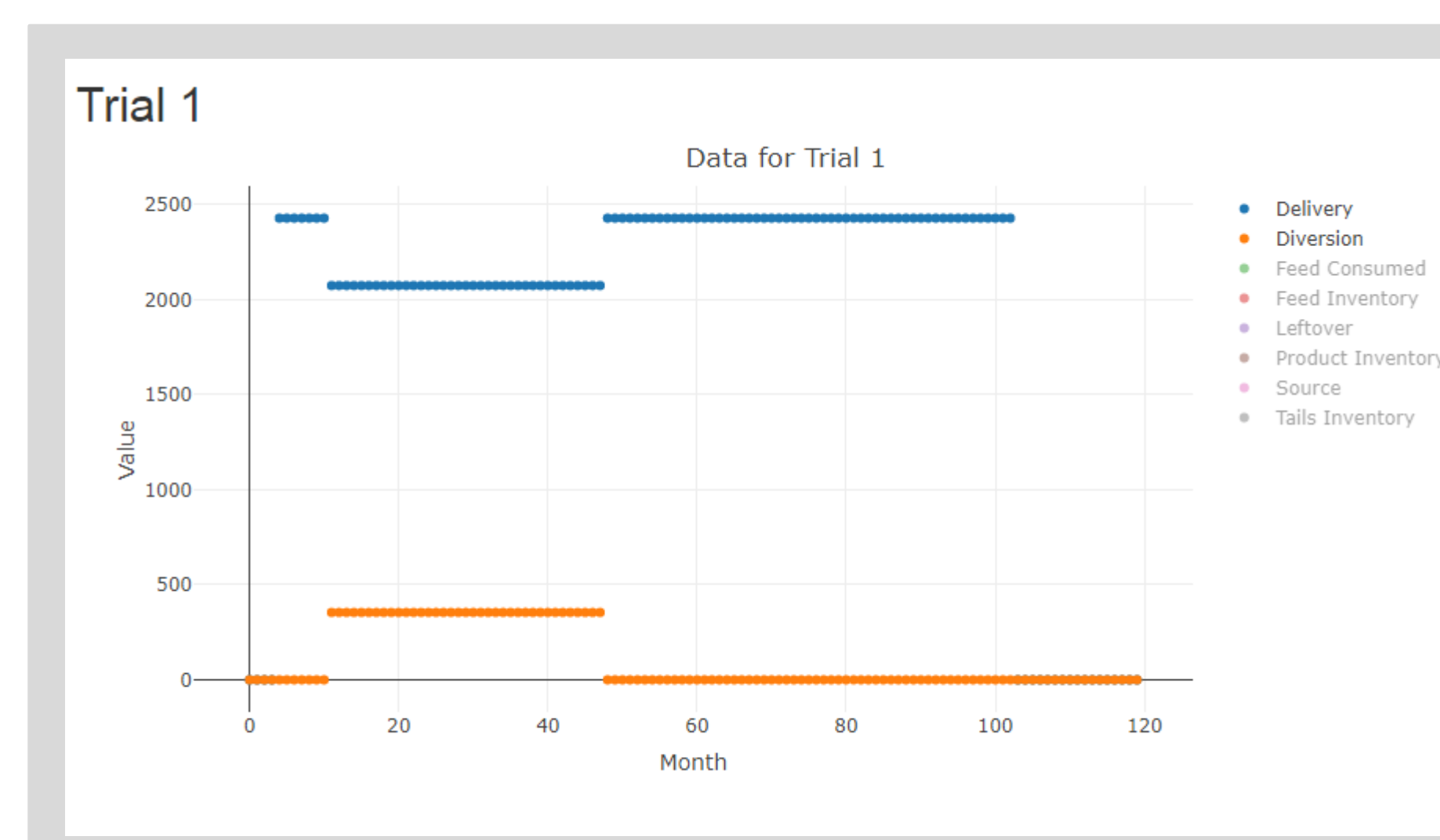
Results

The graphs below demonstrate the interactivity of our visualizations by showing variations of the same scatterplot.
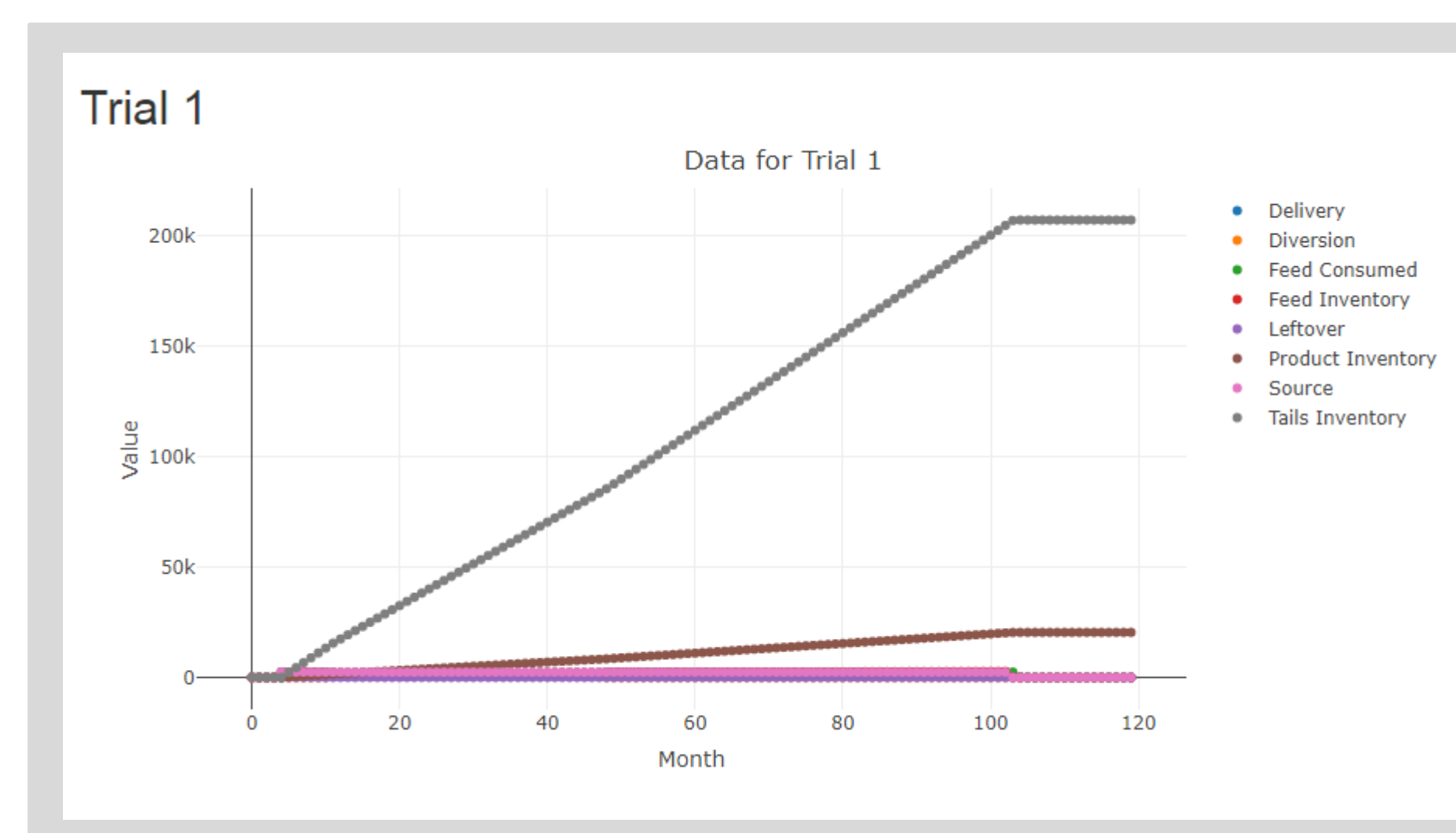
This is the original scatterplot, displaying all the variables at once over the given time period.
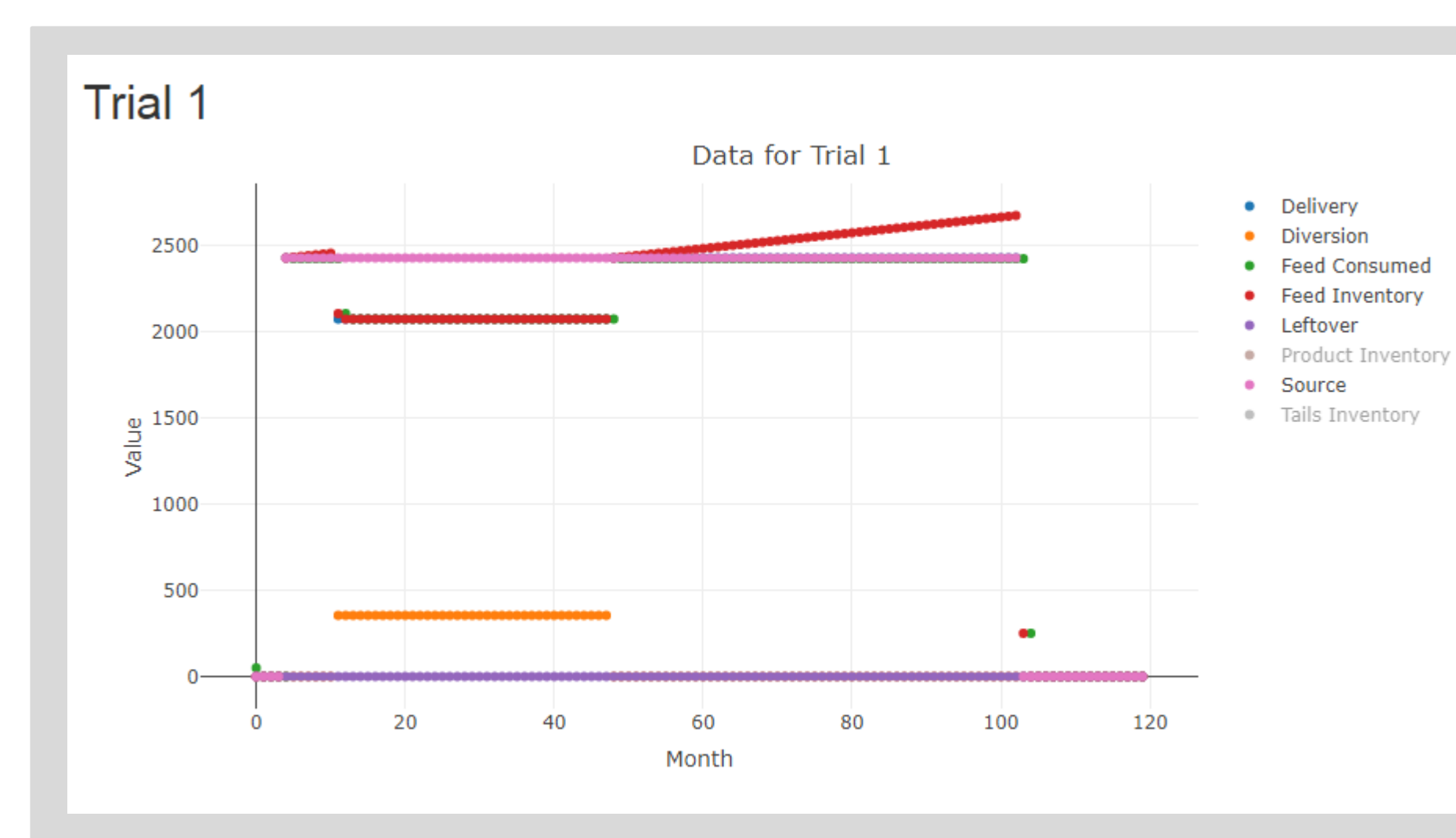

Here the y-axis has been rescaled as a result of two of the variables being removed (see key to the right).

Here we isolate two specific variables to demonstrate interactivity and custom viewing of output data.

Discussion

With these tools, model builders and subject matter experts can rapidly build visualizations in their regular working environment. This allows for efficient communication of key findings to target audiences as they are being discovered.
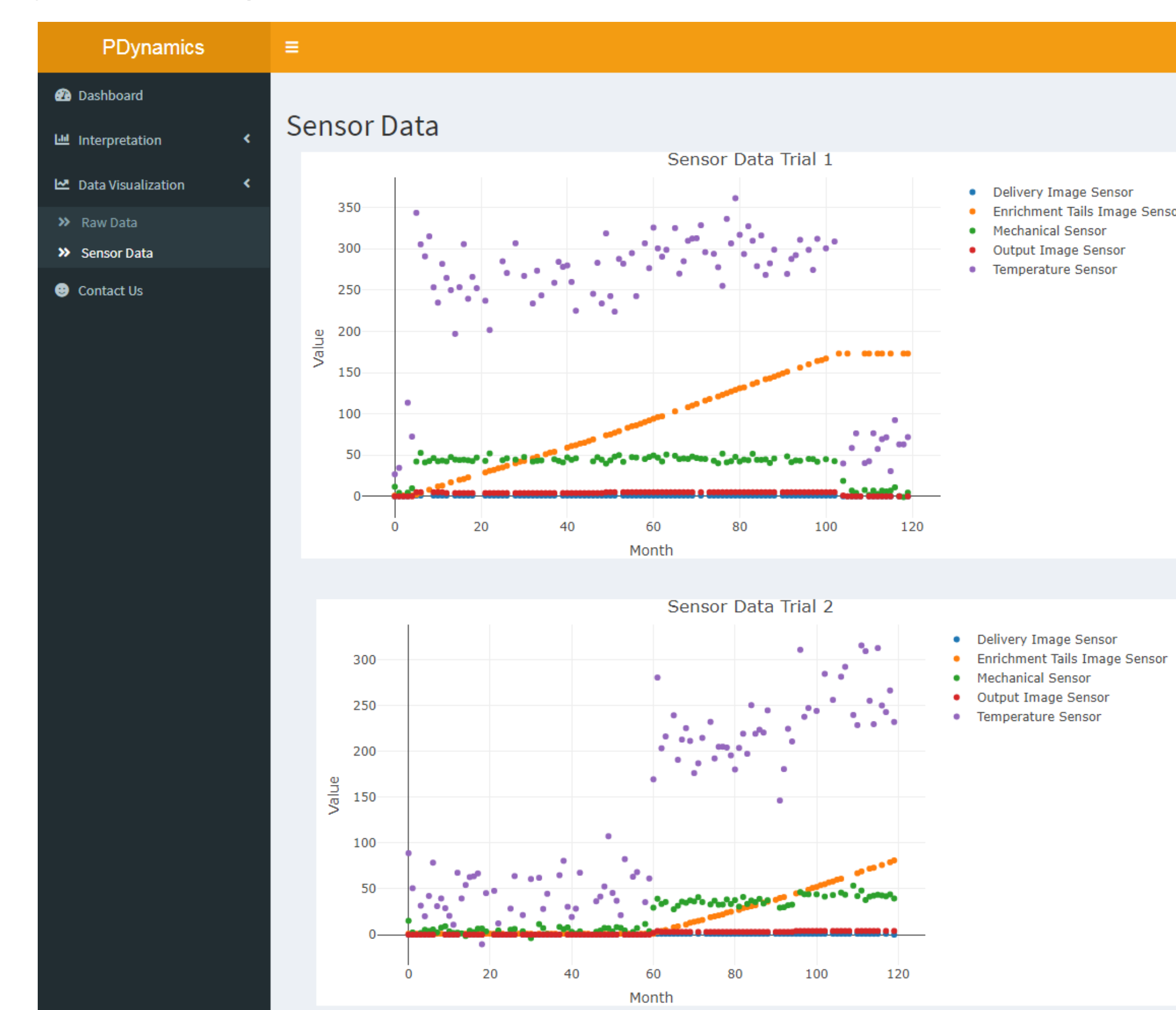
A sample user interface using Shiny Dashboard. This serves as a collection of data and information regarding the Persistent Dynamics Project. The tab shown displays the interactive scatterplots for the sensor data using Plotly.

Highlights of selected R packages:

- Shiny Dashboard allows for clean, organized data collection, and provides the ability to create a dynamic sidebar with a submenu.
- Plotly allows for the creation of various types of interactive visuals.
- Shiny Dashboard is compatible with these Plotly visualizations.

Continued work on this project could involve further experimenting with interactivity when creating visuals, particularly the variety of widgets available using Shiny. This will allow users to select their own parameters for viewing data, which could have several applications for data analysis and visual analytics.

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