

Spring 2013

# Decision Support System for Assembly Line Planning

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## Recommended Citation

Renu, Rahul Sharan and Mocko, Gregory Dr., "Decision Support System for Assembly Line Planning" (2013). *Graduate Research and Discovery Symposium (GRADS)*. Paper 82.  
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## Objectives

- Support TVG authoring by providing:
    - Automated product bauraum representations
    - Automated time study estimations
  - Support line balancing and change management by providing an intuitive interface for planners to modify balances
- Develop an integrated Workstation and TVG information model**
    - Use existing TVG information model and relate it to a workstation model
    - Support Line Balancing edits using the integrated information model
  - Develop a tool to generate bauraum representations**
    - Bauraums are virtually demarcated workspaces. Product bauraum is the final resting location of the part
    - Use CAD data or assembly coordinates to compute product bauraums
    - Write computed information to central database for TVG authoring
  - Extend Bauraum tool to output information for querying MTM charts**
    - Use product information and plant layout data to automate querying of MTM tables and therefore reduce possibility of human error

## Functional Block Diagrams

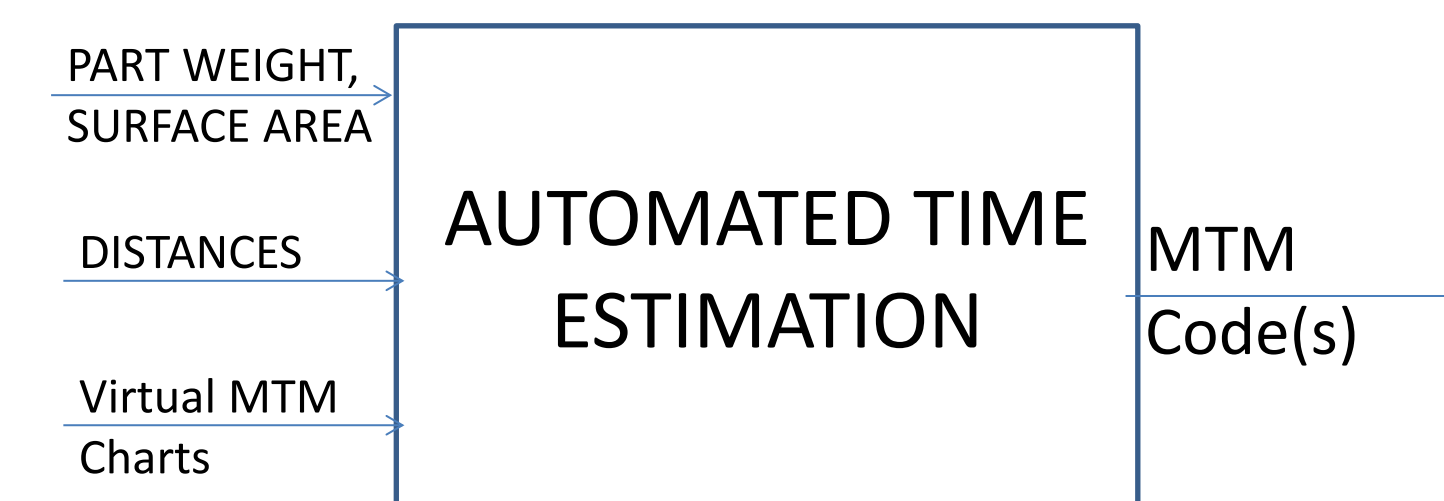


Figure 2: Functional block diagram of Bauraum Identification Tool and Automated Time Estimation Tool

## System Architecture

- Bauraum Identification Tool**
  - Inputs CAD models of the vehicle; and plant layout
  - Outputs product bauraums and MTM codes
  - Uses product bauraums and other part information to chose an appropriate MTM code
- TVG Authoring**
  - Allows planners to author TVGs using controlled vocabulary
- Workstation Model**
  - Stores and allows users to edit workstation information
- Line Balancing Tool**
  - Takes TVGs and workstation information as input
  - Outputs TVG\_assigned\_to\_station
- Visualization Tool**
  - Inputs TVG\_assigned\_to\_station and creates a visual representation of the entire assembly line
  - Allows planner to modify the balance by moving TVGs around, within the restrictions of the various space and time constraints

## Prototype Tools

### Bauraum Identification Tool

The Bauraum Identification Tool has been implemented. The code has been incorporated into SolidWorks through an API. The following are the outputs as obtained from the Bauraum Identification Tool

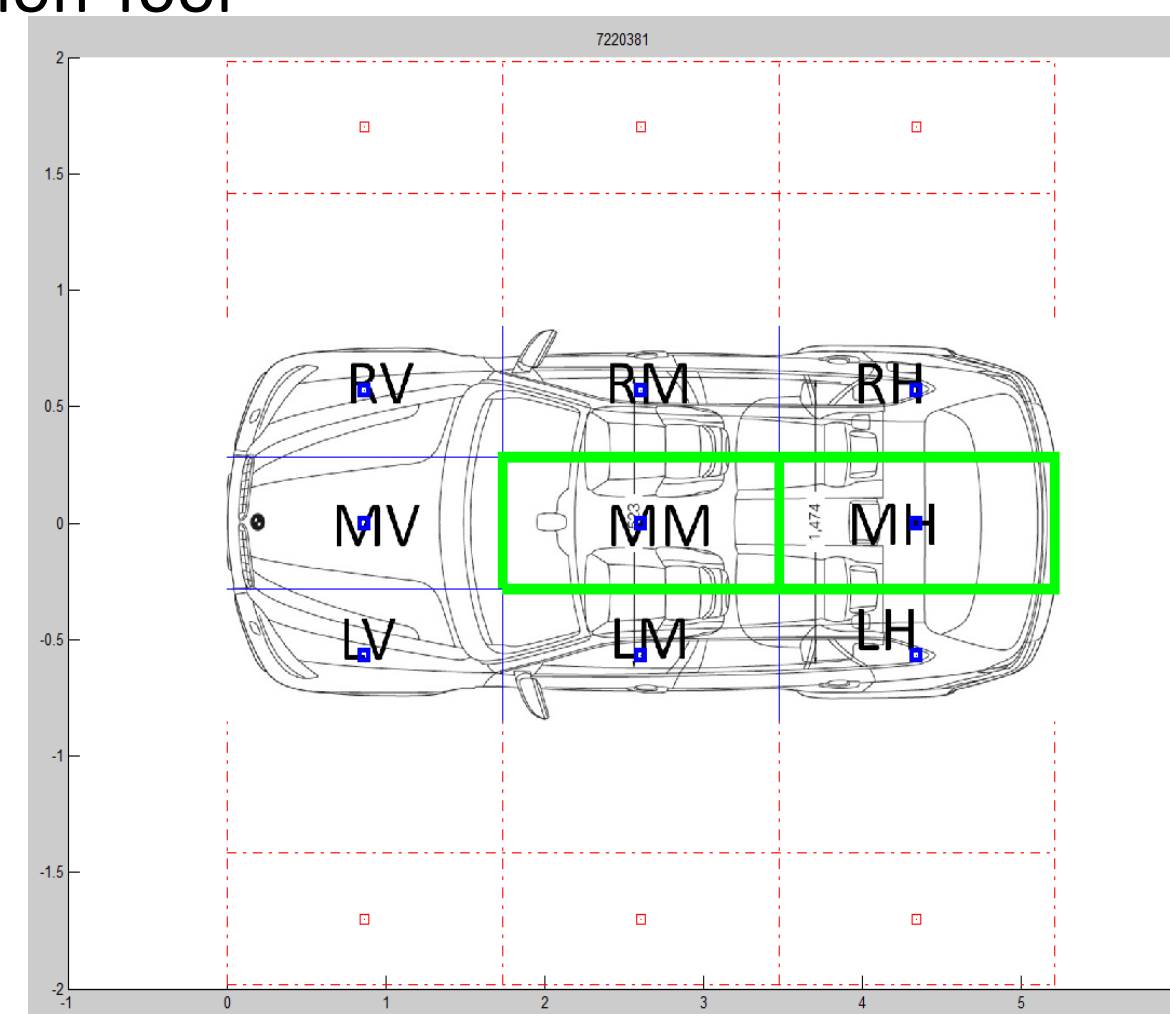


Figure 3: Product bauraum pictorial representation

Part	Volume	Area	Mass
car_body_part-3	0.76647	23.94720	0.00766
7271357-2	0.02188	0.47500	0.00022
7220381-1	0.04859	1.39181	0.00049

Figure 4: Product information output from Bauraum Identification Tool

Part	Distance to bin
7271357	2.943
7220381	8.190

Figure 5: Distance to bin output from Bauraum Identification Tool

## Prototype Tools

### Automated Time Estimation

Selecting and parsing MTM tables is an error prone process. To reduce the chance of error occurrence, MTM table selection and parsing must be automated. This automation is enabled by information inputs from the Bauraum Identification Tool and structured work instructions. This website was created using PHP and HTML queries.

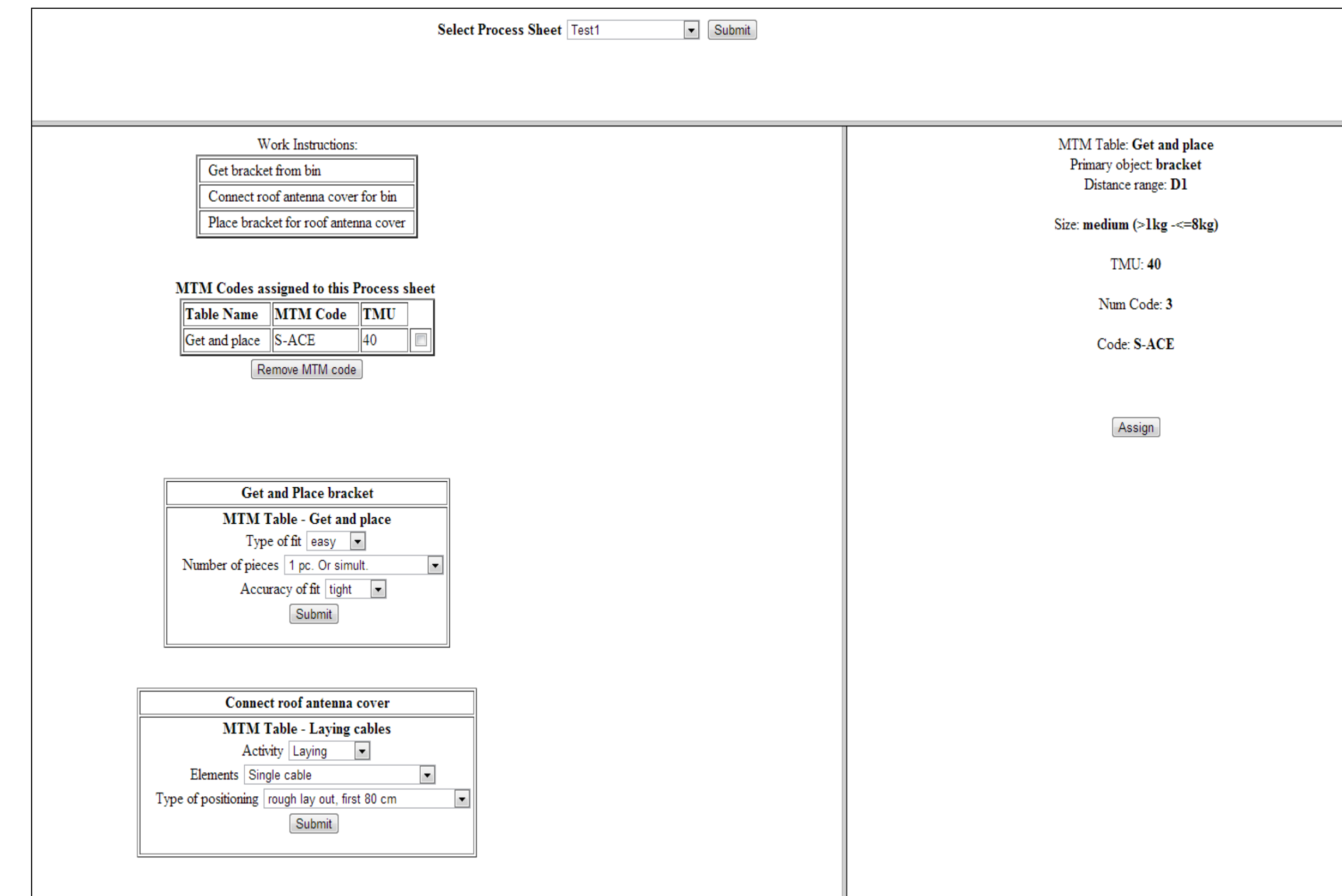


Figure 6: MTM estimate generator

### Visualization Tool Implementation

The visualization tool has been implemented and a screen shot is shown below. Different colors indicate violation of different constraints.

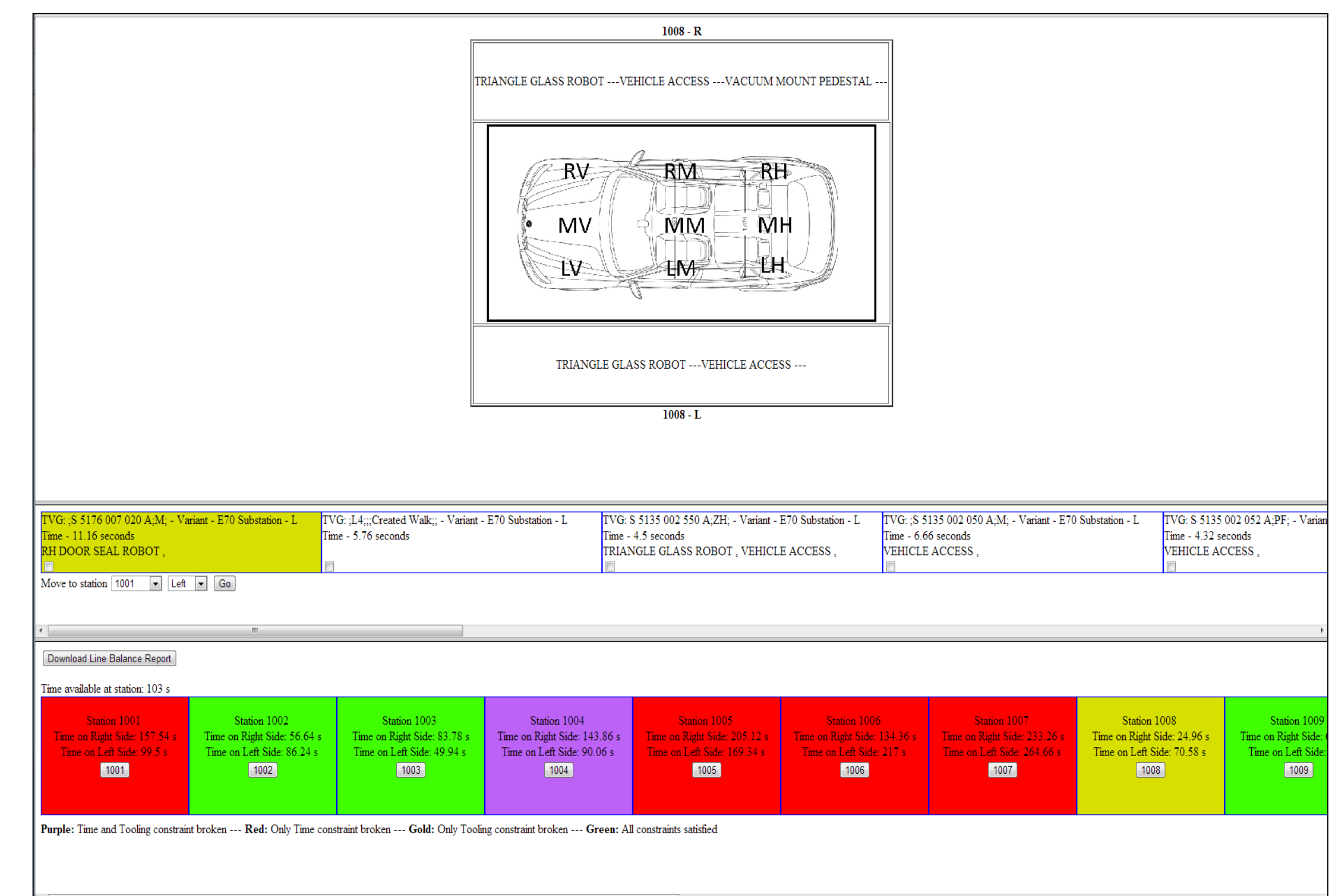


Figure 7: Functional prototype of line balance visualization tool

Figure 1: Information Flow Diagram – Representation of the assembly planning system in its entirety