Gente Ipsum: Improving the Database

Nicholas Carwin, Deborah Huh, Joseph Kim, Chanakarn Karnchanavetchakul,
Evan Kirkpatrick, Tham Panichtrakul, Kenneth Wibisono

Problem Background

Genie, a Terex brand, is a manufacturer of aerial work platforms such as boom lifts, scissor lifts, and elevating platforms, located in Redmond, WA.

The Gente Ipsum team was tasked with a revamping of their current database system within the fabrication department, all while preserving the existing First-In-First-Out (FIFO) scheduling regimen.

Current Underlying Issues
- **The current database is sluggish and causes discrepancies in data tracking due to overloading system inputs.**
- **The Engineering Change Notice (ECN) notification process is difficult to access and accrues unnecessary material, storage and labor costs.**
- **The current interface of the database contains unnecessary information and missing necessary information for operators to finish tasks efficiently while maintaining quality standards.**

Material & Information Flow Map
Gente Ipsum's first course of action was to gain a better understanding of the fabrication process the project would be centered around. The team conducted various interviews with the operators and observed the cutting and forming process to develop an accurate and detailed Material & Information Flow Map (Figure 1). The team used this as a tool to better understand the process, while also providing beneficial information to the Genie IT department. This map embodies the formation of the queries that are necessary for the database to operate as well as tracking the information flowing from one location to another.
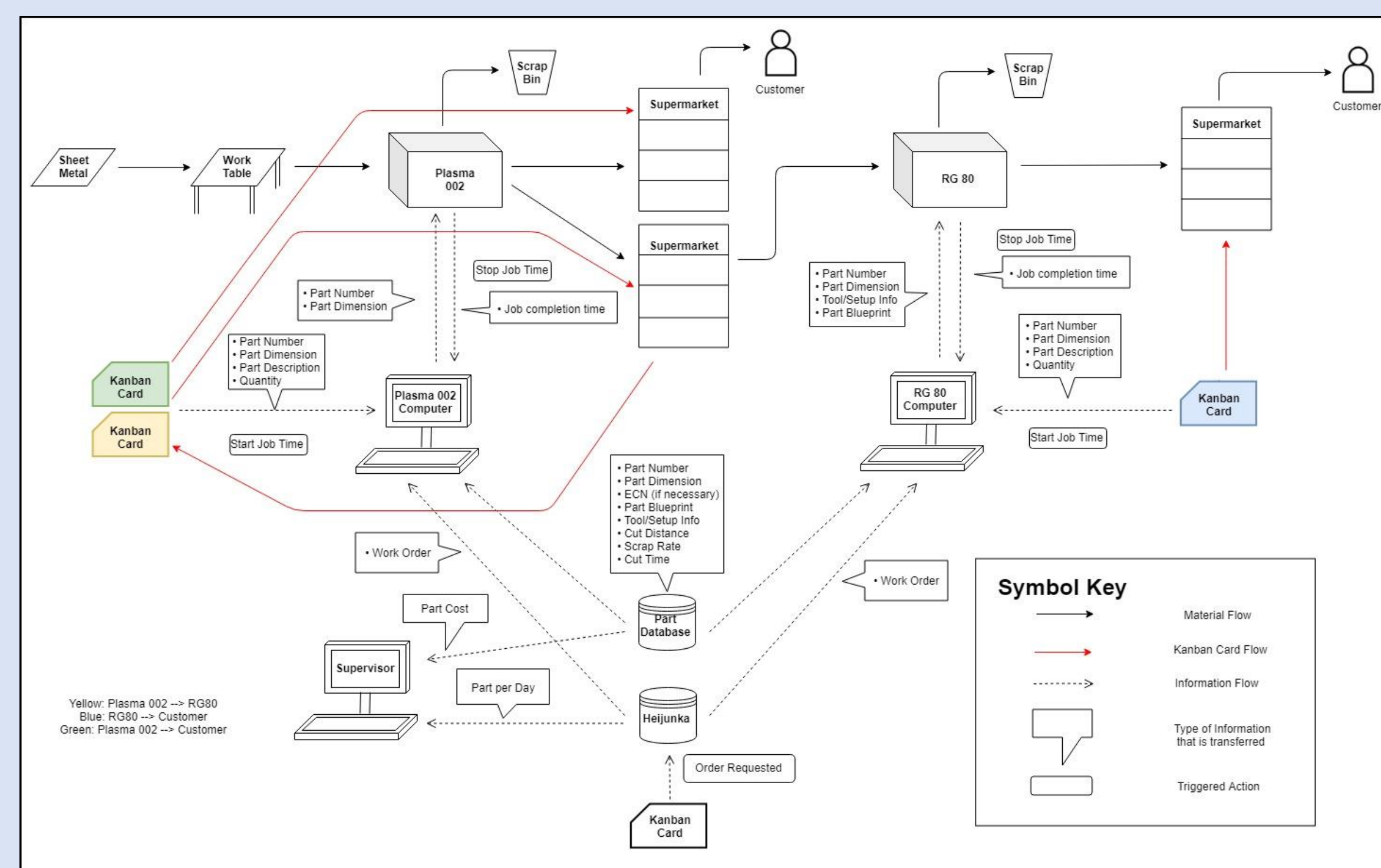

Figure 1: Material and Information Flow Map of Current System

Project Goals

The main goal of the project was to reduce the time operators spend on the database to increase the time toward actual production processes for the ultimate result of increasing the revenue earned by Genie. In order to achieve the goal, Gente Ipsum identified the following actions:
- **Increase the processing speed by optimizing the data processing methods.**
- **Optimize the data presentation by excluding any unnecessary information.**
- **Improve the interface design by making it more user friendly.**
- **Fix deficiencies identified by the operators:**
    1. **Engineering Change Notification process.**
    2. **Machine Out of Service reporting procedure.**

Systematic Improvements

Out of Service Functionality
Problem: When machines go out of service, operators are not given enough Space to explain why the machine down.
Solution: Increased the character limit on the Out of Service text box.
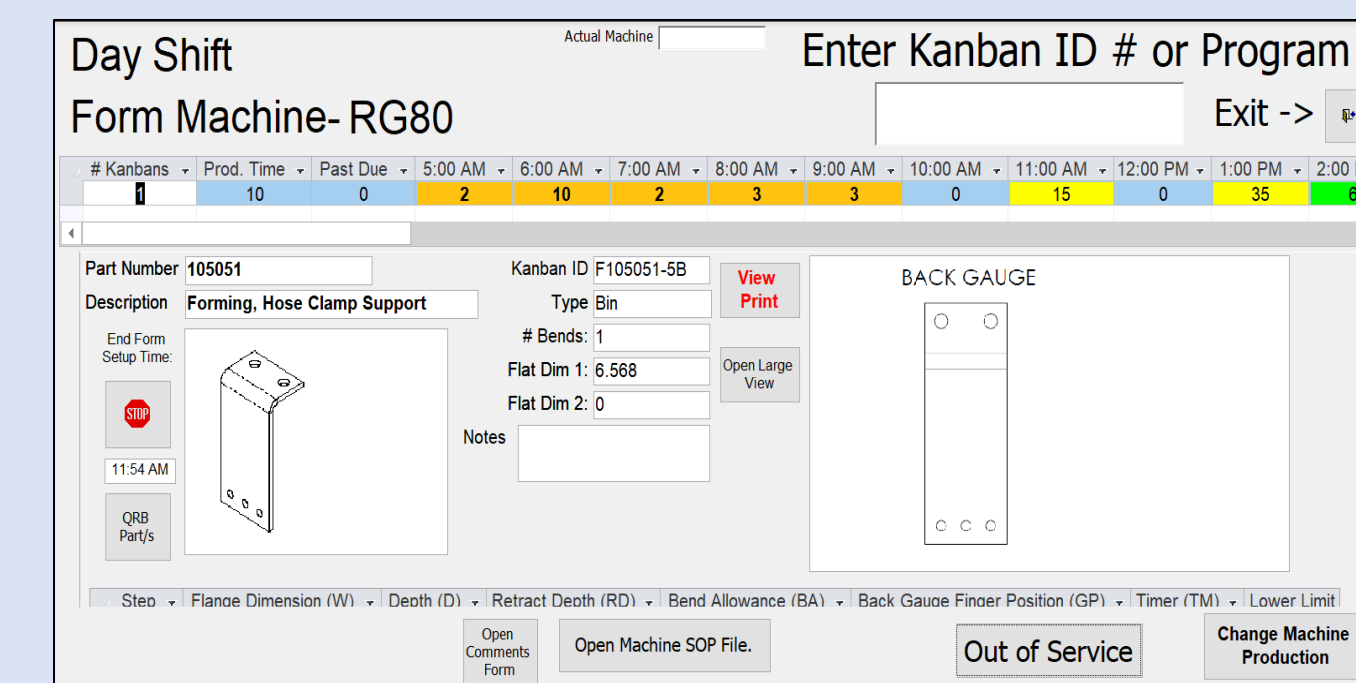**Impact:** This improvement will supply higher quality information to explain why machines are out of service.

Figure 2: RG-80 Machine Production Page

Engineering Change Notice
Problem: The current system for implementing ECN's has led to unnecessary waste in materials, labor, and time, due to the operators not having a way to efficiently verify that a part has been changed.
Solution:
- When uploading the part changes onto the computer, the person updating should leave a note on the computer to notify operators of what part was changed.
- An initial part drawing should be uploaded as well as the part metrics once the new part is being implemented.
- When a work order is requested for the new part, the order should require one extra part to be produced, to serve as a template for future quality checks.

Impact:
- Elimination of defective parts will save approximately $873.00 per year in rework.
- Operators will save 3 work days' worth of searching for drawings per year.

Speed Improvements
Problem: Slow processing speed of the database causes the delays in production and human errors in operator tasks.
Solution:
- Improve the table relationships by efficiently linking related tables, to eliminate queries and enhance database processing speed.
- Add an index for the fields on the tables to allow the database to more efficiently search for and recall data in queries.

Impact:
- From time studies, a 10% reduction in lag was found.
- Operators will save an estimated 196.5 hours per year from having to wait for database pages to load.
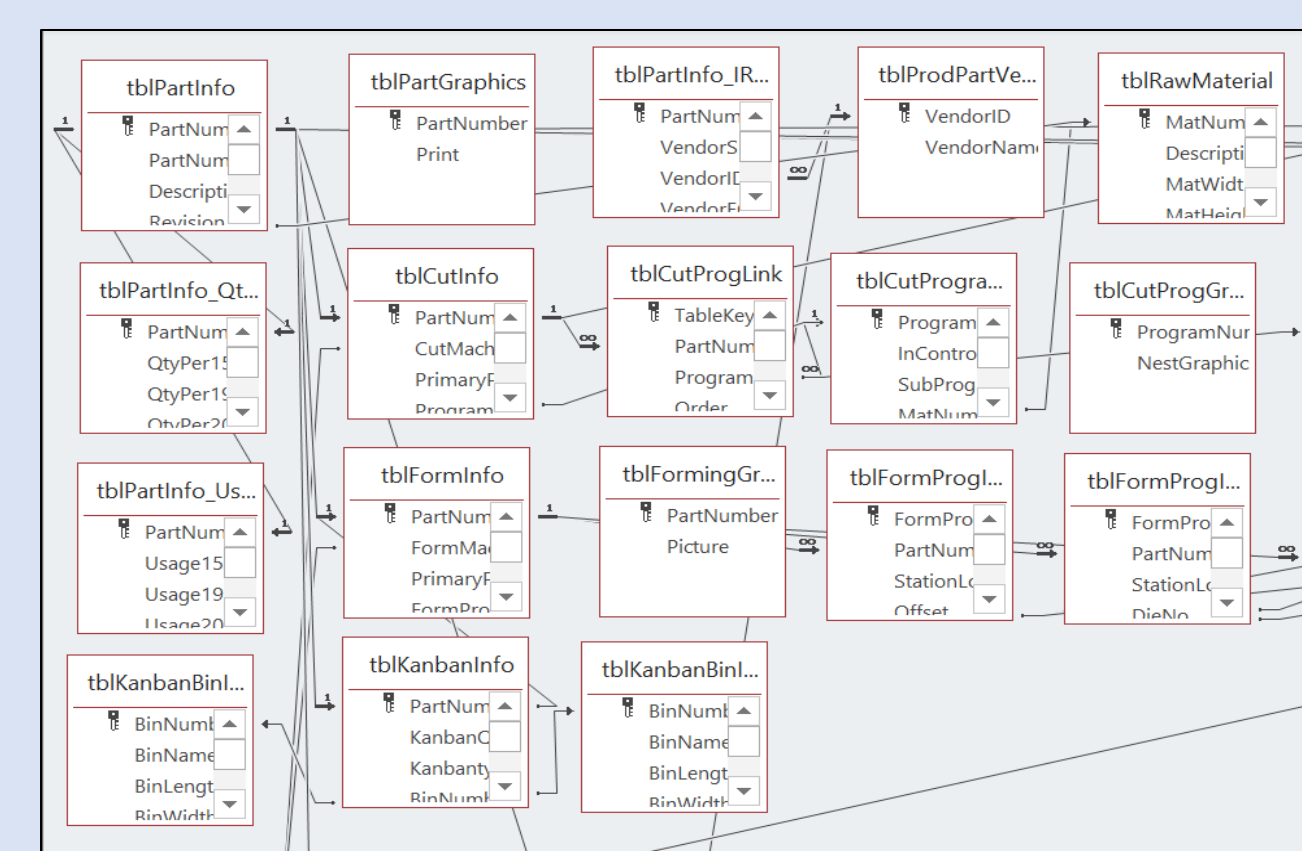

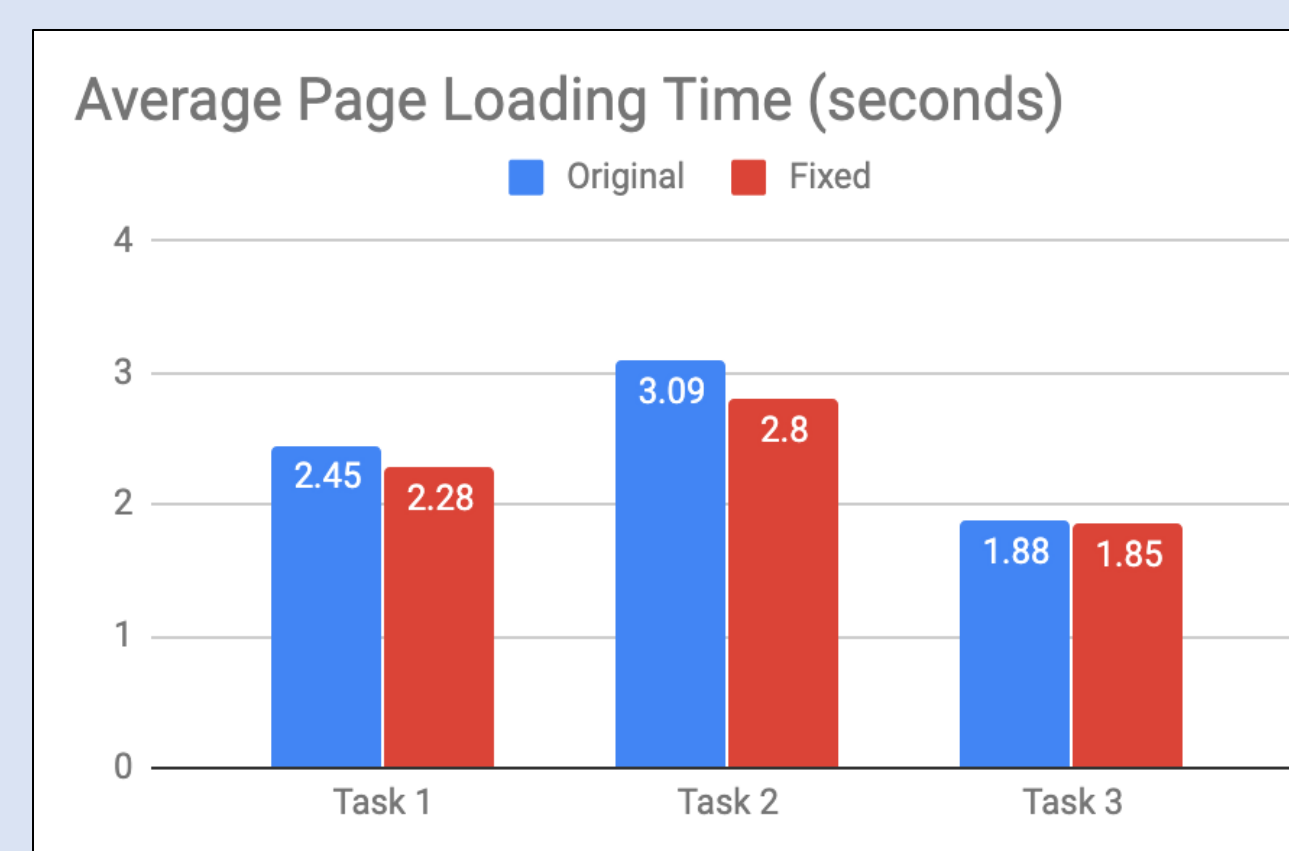Figure 3: Table Relationships in the Access Database
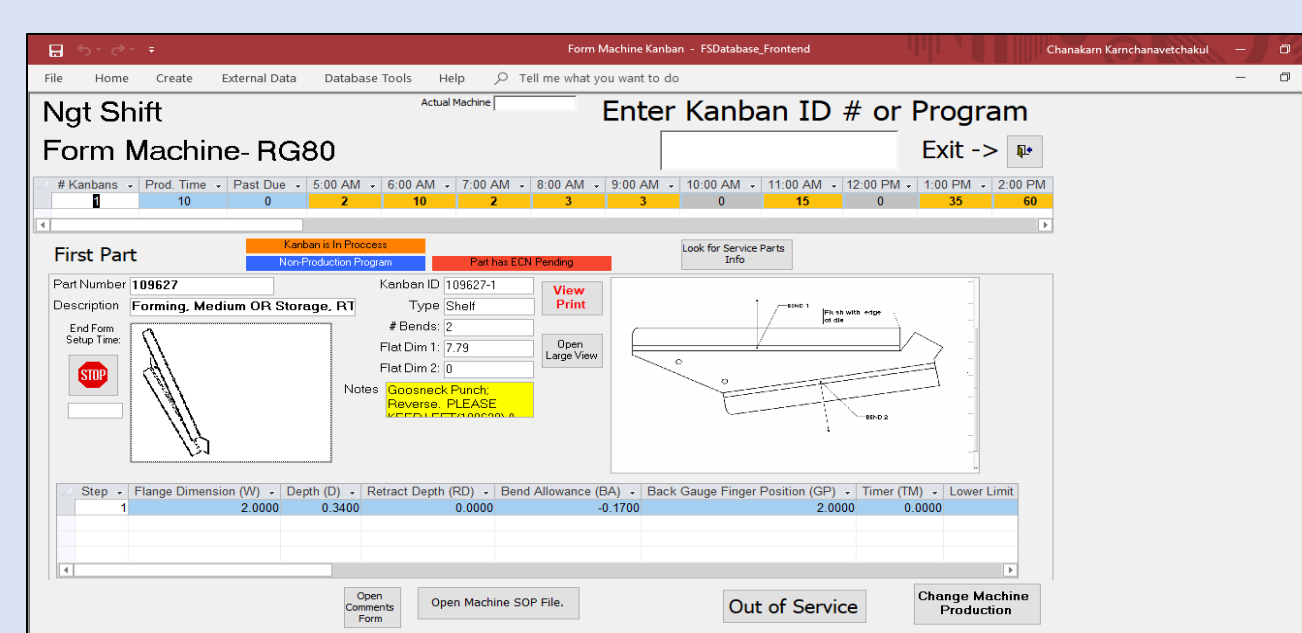

Figure 4: Page Loading Time Improvements

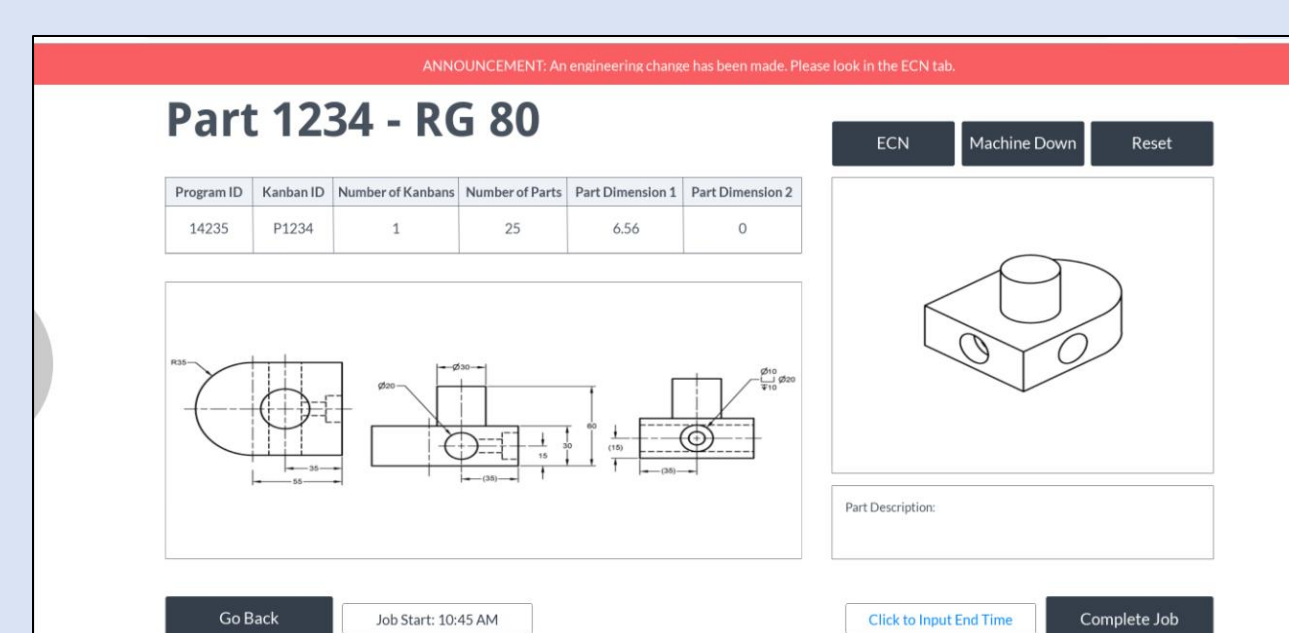Figure 5: Current Machine Production Page

Figure 6: Improved Machine Production Page

Interface Improvements

Gente Ipsum developed a wireframe design interface prototype upon five key factors listed below. The team employed these aspects of fundamental basis of interface design to ensure that the prototype will be an effective replacement for the existing design.
- **Reduce redundancy:** All pages or screens must not have any redundant information to reduce information overload and wasted space.
- **Mistake-proofing:** Introduce tools such as pop-ups, notifications, and alert messages to prevent users from making mistakes
- **Improve visualization:** Emphasize visibility of buttons, texts, and numbers by adjusting font sizes, colors, and position.
- **Satisfaction:** Verify that potential users are satisfied with the prototype by conducting qualitative surveys with test participants.
- **Feasibility:** This prototype contains all qualities from the existing interface and should be able to be implement without extensive refinement or additional resources.

Data Analysis and Impact

The Gente Ipsum team created an interface test to verify the effectiveness and usability of the prototype. The test was designed to mirror many of the tasks that the operators are required to perform on a daily basis. Metrics such as completion time, error frequency, and user satisfaction were gathered to measure the success of the prototype. Each run contained a different iteration of the prototype to deter the effects of any learning curve advantage.
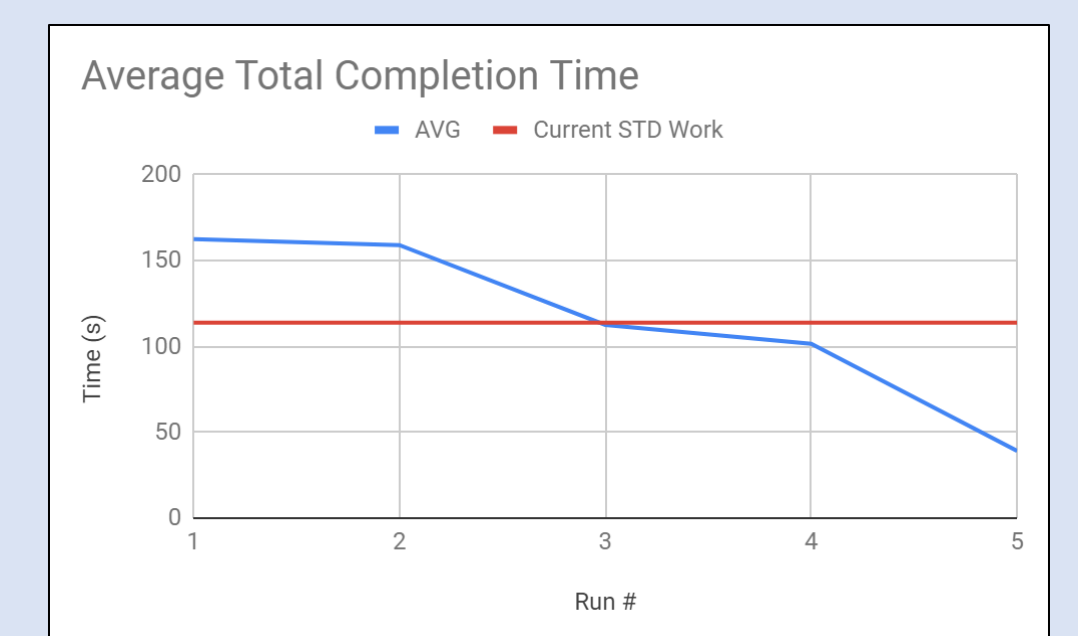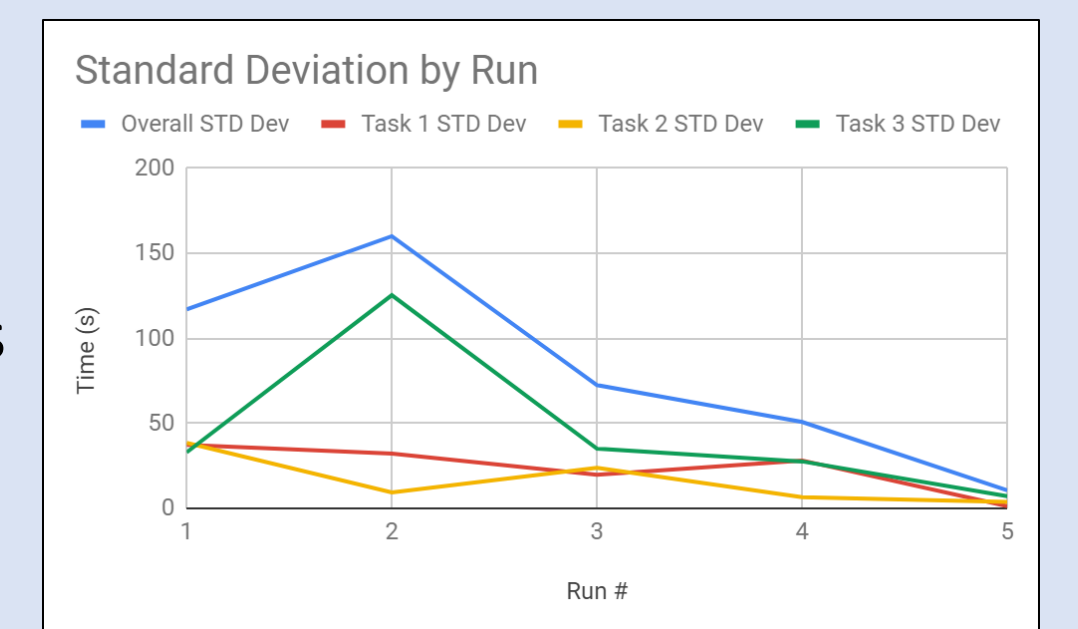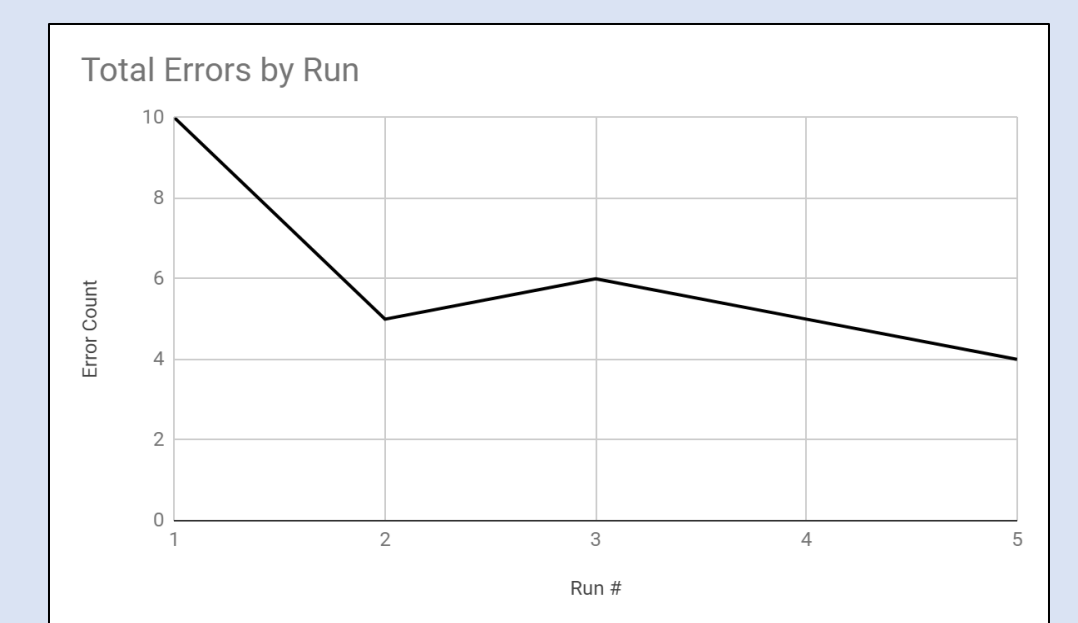

Figure 7: Average Total Completion Time

Overall Results
- The overall standard deviation was decreased from a maximum value of 160.1 to 10.76 seconds over 5 runs.
- The current standard work time of 114 seconds was reduced to 39 seconds on the prototype.
- Total error count was reduced by 60% across all operators.
- All participants gave a satisfaction score of at least a 4 out of 5 by the final test session.

Interface Improvement Impacts
- Time spent on the database is reduced by 65% per standard part cycle.
- Reduced operator errors and increased satisfaction.

Figure 8: Standard Deviation by Run

Figure 9: Total Errors by Run

Recommendations

The following recommendations cover areas that the Gente Ipsum team could not cover during the limited scope of this project:
- Make changes to the ECN updating procedures with the recommended steps.
- Revamp the database with the improved interface provided.
- Declare variables using an 'Option Explicit Statement' in Microsoft Access to improve the processing speed.
- Transition to a more modern database tool such as SQL Server.
- Improve the hardware and network to increase overall speed of programs.

Acknowledgements