Improving Manufacturing through the Automation of Report Generation

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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Technical Report

ABSTRACT

In the small manufacturing company where I interned last summer, one of the managers had to manually search for and copy the data found in their ERP software into reports. This was done daily and could take up to an hour depending on the type of report. To resolve this problem, I created an application that automatically pulls data from a database and generates reports. I used SQL Server Management Studio (SSMS) with a task to pull and format the data from the database into usable tables every hour. From there, I used a Django web application that pulled from the preformatted tables and automatically populated a report. The major outcome of this project was the instantaneous creation of reports, which originally took more than an hour, thereby saving the company valuable time. Future work for this application would include adding a more robust testing library to lower the chances of unforeseen consequences. Additionally, the application could use a feature that allows people to sign up for emails containing the reports.

1. INTRODUCTION

Businesses that are forced to make decisions using out-of-date or inaccurate information often make the wrong decisions. When a business continues to make the wrong decisions, it suffers: running out of inventory, falling behind on orders, and losing customers and money. Any company that continues to suffer from these problems will eventually fail. Recognizing the importance of accurate and up-to-date information in the business world, and the potential consequences of a lack thereof, I designed a solution that would mitigate the risks associated with outdated data.

In the small manufacturing company where I interned last summer, one of the managers had to manually search for and copy the data found in their ERP software into reports. This was done daily and could take up to an hour depending on the type of report. In a growing company with a small but dedicated staff, the extra hours spent daily creating a variety of reports detracted from the efficiency and productivity of the organization. The problem that motivated my report-generating application was rooted in the inefficiencies and time-consuming nature of the reporting process.

To combat the outlined problems, I developed an innovative application that revolutionized the way the company accesses and utilizes data. Instead of struggling with manual data collection and analysis which can take hours and risk the potential for human error, my application automatically generates comprehensive reports in real-time. This means that decision-makers no longer have to rely on outdated information to make critical decisions, the most up-to-date and accurate information is at their fingertips.

2. RELATED WORKS

As inspiration for my project, I researched other examples of automating the reporting process. To explore the relationship between the technical and human aspects of technologies, I used Hughes (1987) theory of *technological momentum*. This theory explores the expansion of large technical systems over time and how they become integrated into broader social systems and the environment. It addresses the persistence and influence of existing technologies when more advanced alternatives exist.

A key facet of *technological momentum* is consolidation which can be described as the process of integrating various technological elements into a single, more effective system. The concept of consolidation can be seen with report automation: "Automated reports can be generated for performance, marketing,

inventory, deliveries, purchases, financials, payroll, and many other operations a company relies on to thrive" (Mailchimp, n.d.) Consolidation can also be seen here: "Business reports document the progress of your businesses and the data collected serves several important purposes. It guides strategic decision making, helping business leaders to formulate budget and planning activities for the ensuing year using the report data to back choices and provide justification for each decision" (Unleashed Software, n.d.)

Another aspect of *technological momentum* is the concept of reverse salient, which refers to the concept of a point of technological or organizational deficiency within a system that is behind other components. "A new survey from Reuters Events explains how there is an urgent need to move beyond legacy systems and gain end-to-end supply chain visibility. With these recent events and the changing business landscape, manufacturers need to embrace emerging technology in order to remain competitive" (GrapeCity, n.d.) suggests that organizations without automated processes suffer from a reverse salient. This can also be seen here:

There's one significant asset that manufacturers have not yet optimized: their own data. Process industries generate enormous volumes of data, but many have failed to make use of this mountain of potential intelligence. Historically, manufacturers have lagged other industries in their IT capabilities. However, thanks to cheaper computational power and rapidly advancing analytics opportunities, process manufacturers can put that data to work, gathering information from multiple data sources and taking advantage of machine learning models and visualization platforms to uncover new ways to optimize their processes from the sourcing of raw materials to the sale of their finished products. (McKinsey & Company, 2017)

Another key concept of *technological momentum* is innovation which can be understood as the introduction of new elements, technologies, or practices into a technological system. A recent innovation in the reporting of manufacturing companies is the use of AI. This can be seen in the context of predictive maintenance: "Predictive maintenance is a manufacturing best practice based on a theoretical rate of asset failure. Instead of waiting for something to break, manufacturers use predictive maintenance to preemptively replace parts or tools to reduce downtime. …The increased long-term reliability of processes leads to greater output capacity, increased part quality, and long-term cost savings" (Fast Radius, 2021).

3. PROJECT DESIGN

To understand the project design, it is necessary to consider the system architecture and requirements.

3.1 Review of System Architecture

Finding a way to reduce the time required to create reports used on a daily basis.

3.2 Requirements

I needed access to the database where the data was stored, a locally hosted server capable of running continuously, a software application capable of performing SQL queries (Microsoft SQL Server Management Studio), and a web framework to create a web application (Django).

3.2.1 Client Needs

The company needed a quick and intuitive way of creating reports on a scheduled basis.

3.2.2 System Limitations

One of the limitations I faced was time constraints because the project needed to be finished in the duration of my internship.

Another limitation was the lack of on-site tech support knowledgeable of the ERP used at the company.

3.3 Key Components

The critical components of this project were specifications, challenges, and solutions.

3.3.1 Specifications

The resources used for the project needed to have excellent functionality, performance, aesthetics, and cost-effectiveness for the project to be successful. The application needed to run quickly and effectively and have an intuitive interface that could be easily learned.

3.3.2 Challenges

The challenges faced included creating a system that would effectively and accurately pull data from the database into a usable format and at scheduled intervals. Additionally, the data then needed to be utilized by my software to generate reports in a standardized and readable format.

3.3.3 Solutions

The data was pulled on an hourly basis using "jobs" a feature of SQL Server Management Studio (SSMS). The jobs would query the database every hour and create new tables containing the data required for the reports. The generation of standardized readable reports was done in Django in which I hard-coded the format for a variety of reports. The reports could then be automatically generated in the app using customizable parameters to tailor the reports to the needs of the company.

4. RESULTS

Creating effective and accurate SQL queries proved to be the most time-consuming step in the process. Many of the database tables were unintuitively named and/or did not contain the expected data. This was the most time-intensive part of the process and took more time than the entirety of the other steps. Automating the querying process in SSMS was accomplished quickly using "jobs," which proved effective in formatting the data. Creating the application and interface required hours of research and testing.

The application worked as expected and provides an intuitive and user-friendly interface which allows users to generate preset reports with customizable parameters. The application is still in use and saves the company an average of 10 hours weekly in man-hours which can now be used more effectively in running the company.

5. CONCLUSION

The automation of processes has become an important part of many businesses with the rise of technology. The automation of report generation plays a vital role in increasing the efficiency and accuracy of the reporting process. It was the main focus of my internship, and an area in which I had not previously had experience. However, this is a common process in many companies.

The internship created a project that saved the company lots of time on a regular basis. The ease of access to automatically updated and readable reports is vital in allowing the company to remain competitive in their market. Many companies have similar applications or software allowing them access to up-to-date information.

6. FUTURE WORK

Some future works on this project include developing a more robust testing library. This would ensure that the application is able to identify potential sources of error if the application stops working. Being able to identify the source of the error would save time in the troubleshooting process in the event of failure.

Another potential future work would be the addition of a feature allowing users to sign up

for email updates. This feature would allow access to reports and other information to be emailed to recipients based on set parameters without the need for opening the application.

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