Subcon Report Automation

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Abstract

This project consists of the automation of a report that is done manually on a daily basis at the Finance Department of an aerospace company in Aguadilla, Puerto Rico. By automating the report generation, it is expected to save effort from dedicated resources and allocate those to other tasks. The automation was done through software, being the final product an application which allows the user to input source files and generate the report needed. The development used is based on the Agile methodology to ensure a streamlined process on which available resources can be maximized and the total workload needed for completion can be evenly distributed throughout time, as well as correcting deviations from the final goal by involving constant feedback from the customer. Additionally, the process implements several Design for Six Sigma (DFSS) tools to aid the completion of the automation. Final product was delivered to the customer once completion of requirements was met.

Introduction

A shortage report must be done manually daily by a group at the Finance Department to determine existing material requisitions within an aerospace company in Aguadilla, Puerto Rico. From these requisitions it is determined if there is a shortage in materials that must be addressed. The shortage report indicates to the company's buyers where to direct immediate attention when placing material orders to distributors. The current process is manual and requires the team to redirect attention from other projects that also require to be prioritized. The purpose of this project is to implement automation of the process through software in order to save time and effort. The execution of the project will be done at company premises and/or work-from-home scheme. The current process takes 120 minutes daily. At around 260 workdays per year, the manual process takes 31,200 minutes (520 hours) per year per employee executing the action. Automation of the process expects to take 40% of the time of the baseline, saving 60% of the time. It translates to a saving of 18,720 minutes (312 hours), which at a rate of $15.00/hour represents savings of $4,680 per year per employee.

Problem Statement & Objectives

Problem Statement: Can the report generation be automated through software?

The final product of the automation process has two objectives that are tied to tangible metrics:

Yield: Automated process output is equal to manual process.
Cycle Time: The automated process should take 40% of the time of manual process

Literature Review

In today's global scenario, there is a highly competitive scheme among companies to have standard and streamlined procedures in order to deliver products in a more time-efficient way. There has been the realization that essential aspects of these businesses are also contributing to operation costs. It is then when having technology embedded into the infrastructure becomes a necessity rather than a luxury to achieve cost reductions. The importance of having such technologies is a differentiator on a global scale for companies already in the market [1].

Automation is a topic well-discussed on these corporations since is it a realm of technology were certain tasks that does not require critical thinking can be accelerated using machines or code within them. The companies using technologies for automation of processes depend on their organizational resources to be placed into work that eventually transform inputs into outputs [2]. Examples vary across industries; one of them is the automotive industry. Several steps along the process involved methods that can be done by an automated part and not a human operator [2]. Furthermore, automation concepts have been taken into the field of software testing, were automated software can test another piece of code [3]. Not only will the testing be faster, but less prone to human error and consistently achieving same outputs from the same sets of inputs [3].

A common denominator exists among these examples and that is the saving of time. Time can be translated into the usage of resources and such usage has an intrinsic cost based on time. It is a correlation that has produced a shift on companies' behaviors to decrease the tangible effect it has on revenues [4]. In the companies across the United States, automation could save up to $4.7 million USD per year [4]. Automation has allowed companies to make processes more efficient and cost-savings, allowing such resources to be allocated to tasks that are more human-dependent. But there is an automation possibility even for tasks that are not so trivial to execute. Artificial Intelligence is among the horizon to become mainstream technology that could tackle duties worth of a human brain. Code that learns from experiences and becomes increasingly complex by itself could put an end to the limits of current automation capabilities [5].

Methodology - Description

The approach from an organizational perspective consisted of a modified version of the SCRUM Agile methodology. The team was comprised of two software engineers that moderate the procedure through the selected methodology and served as developers for the process. One of the team members acted as the Product Owner, being the main liaison between the customer and the team. Design for Six Sigma (DFSS) tools were implemented in the project's development to ensure maximum use of available resources and customer satisfaction. An initial meeting was held with the customer in order to delimiter overall requirements and establish the customer needs by means of Voice of Customer (VoC) tool, as shown in Table 1. Then, a Fishbone Diagram was developed to understand the causes and effects of the issue to be solved, as shown on Figure 2. After gathering the initial information from the customer, a Thought Map was developed to further expand on the knowns and unknowns of the process. The Thought Map also provided possible resolutions on the unknowns, such as meetings and implementation of other Design for Six Sigma (DFSS) tools. The tool is shown on Table 2.

One of the unknowns established using the Thought Map Tool was to determine which programming language along with its respective development environment was the most appropriate for this project. Using the Pugh Selection Concept Matrix shown in Table 3, it was determined that Python programming language was the better suited for the project based on a set of criteria that the team decided were needed. Each criterion had a weight added to each based on the team's decision. Each '+' symbol was multiplied by the criteria's weight and added to the weighted total of each programming language. Each '-' symbol was multiplied by the criteria's weight and subtracted from the weighted total of each programming language. A timeline was created based on follow-up meetings with the customer; it contained phases with their respective subset of goals and deadlines. By following the selected methodology, each phase represented a fixed time allotment called sprint (two weeks each) and at the end of each sprint there was a meeting with the customer to present each phase (represented by a sprint) results. This allowed the team to have a constant feedback from the customer in order to minimize deviations from determined goals. Figure 1 details how each phase was structured.

Methodology – Timeline

This section contains the timeline with four phases (or sprints) used during the development of the project. Each phase had a distinct set of goals and deadline to deliver to the customer.
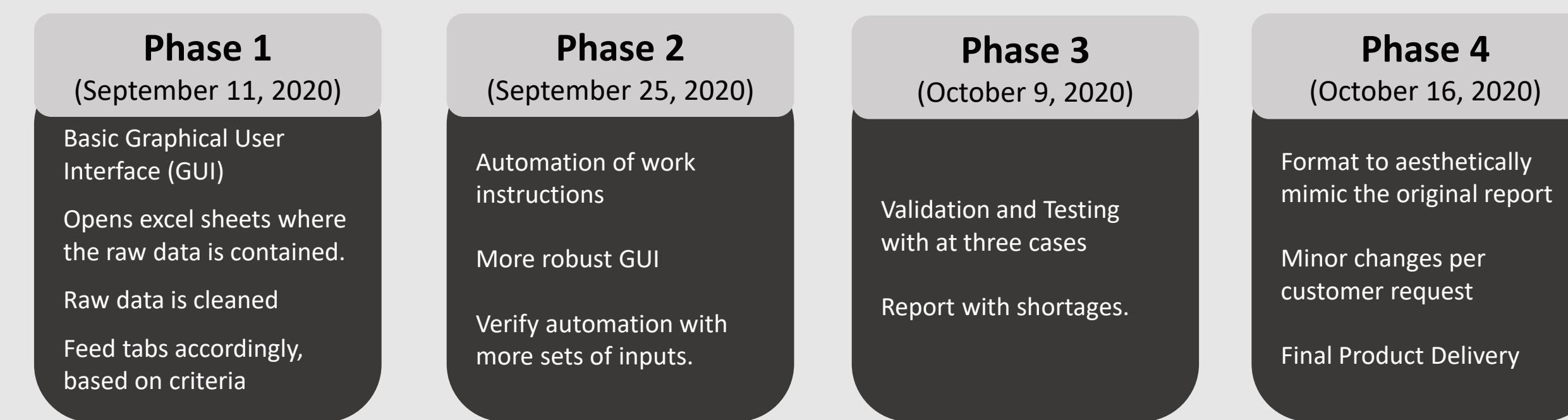
Phase 1 (September 11, 2020)	Phase 2 (September 25, 2020)	Phase 3 (October 9, 2020)	Phase 4 (October 16, 2020)
Basic Graphical User Interface (GUI) Opens excel sheets where the raw data is contained. Raw data is cleaned Feed tabs accordingly, based on criteria	Automation of work instructions More robust GUI Verify automation with more sets of inputs.	Validation and Testing with at three cases Report with shortages.	Format to aesthetically mimic the original report Minor changes per customer request Final Product Delivery

Figure 1. Project Development Timeline

Methodology – DFSS Tools

This section contains the Design for Six Sigma (DFSS) Tools used for the project. Description is contained in the Methodology Description section.

Table 1. Voice of Customer (VoC) Tool

Customer Needs	Customer Baseline	Significance to the Customer	Priority	Differentiator?
Automation of work instructions	Manual procedure established in work instructions	It is highly significant since it is a time consuming procedure done daily.	High	Yes
Creation of Shortage Report	None (Except for a draft on how to generate the shortage report manually)	It would provide a report of those requisitions that are at risk of not being met due to material shortages.	Critical	Yes
Report Format	Manual Report	Customer needs report format to be similar to manual report for consistency purposes.	Low	No
Easy-to-Use Interface	None. Current manual process does not have an interface (other than Microsoft Word or Excel)	It would expedite the training of new members on how to prepare the report with our solution.	Medium	No
Fast Report Generation	Manual procedure takes around 120 minutes.	Not only automation matters, but also the speed of such process.	Medium	Yes

Figure 2. Fishbone Diagram

Table 2. Thought Map Tool

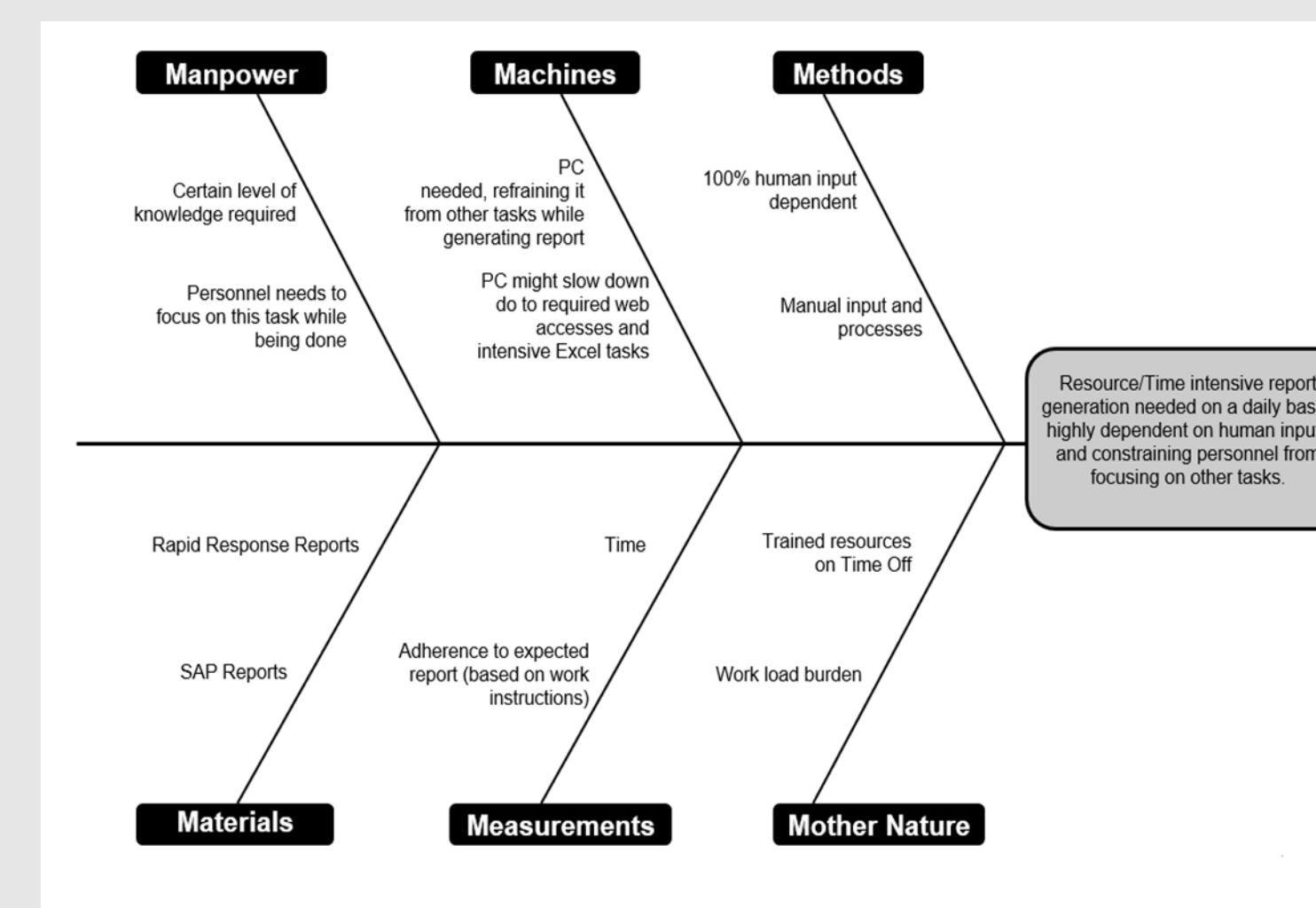| Things we know	Things we don't know / Questions we have about how to reach our goal	How we can answer each question (or which ones we won't answer yet)	Results
Time it takes to generate report manually (around 2 hours)	How this time is split among internal tasks (Retrieving info, following work instructions)	Ask costumer for details	Meeting with customer yielded needed information
Portion to be automated (Work instructions)	Tools to be used for coding/automation	Internal research and brainstorming	Generate Pugh Concept Selection Matrix
Customer wants Final Shortage Report	Specificity on format, logical approach to generate it.	Ask customer for details	Meeting with customer yielded needed information
Goals to be accomplished	How to distributed work load among team members	Internal team meeting to reach agreement	Meeting among team members was held at the beginning of the process
Product to be delivered	How to split total work into smaller segments, with demos to customer and frequent feedback	Internal team meeting to reach agreement	Four phases with milestones

Table 3. Pugh Concept Selection Matrix Tool

Requirements	Weight	Python	Java	C#
Open source	1	+	+	+
Library for Data Frames	2	+ (Pandas)	+	+ (.NET DataFrame)
Library has Excel format compatibility	2	+	- (most only support CSV)	- (only CSV support)
Must have portability for executable delivery	1	+	+	-
Fast Data Processing	1	+	-	-
Basic GUI Support	1	+	+	+
Sum of +		8	5	4
Sum of -		0	-3	-4
Weighted Total		8	2	0

Conclusion

The project had two main objectives: to make the automated process output equal to the manual process and to make the automated process take 40% of the time of manual process. Both objectives were successfully tested during Phase 3 and Phase 4. The customer also provided feedback the same day of delivery, confirming the completion of the objectives. Figure 3 shows the final product deliverable provided to the customer. The automated process output was the same as the manual process and the automated report generation took 138 seconds (2.3 minutes). This time is a significant reduction from the manual process and well below the original objective. Some recommendations were given to the customer to be considered for any future developments. Such recommendations are based on current limitations identify for this release of the application:

- Connection to the company databases in order to obtain source files without user intervention.
- Generate and send an email with the report attached to a predetermined list of contacts each time the report is generated.
- Develop logic to determine if the user is selecting the correct source files.

- Lightweight, standalone installer (130MB)
- Compatibility with Windows 10
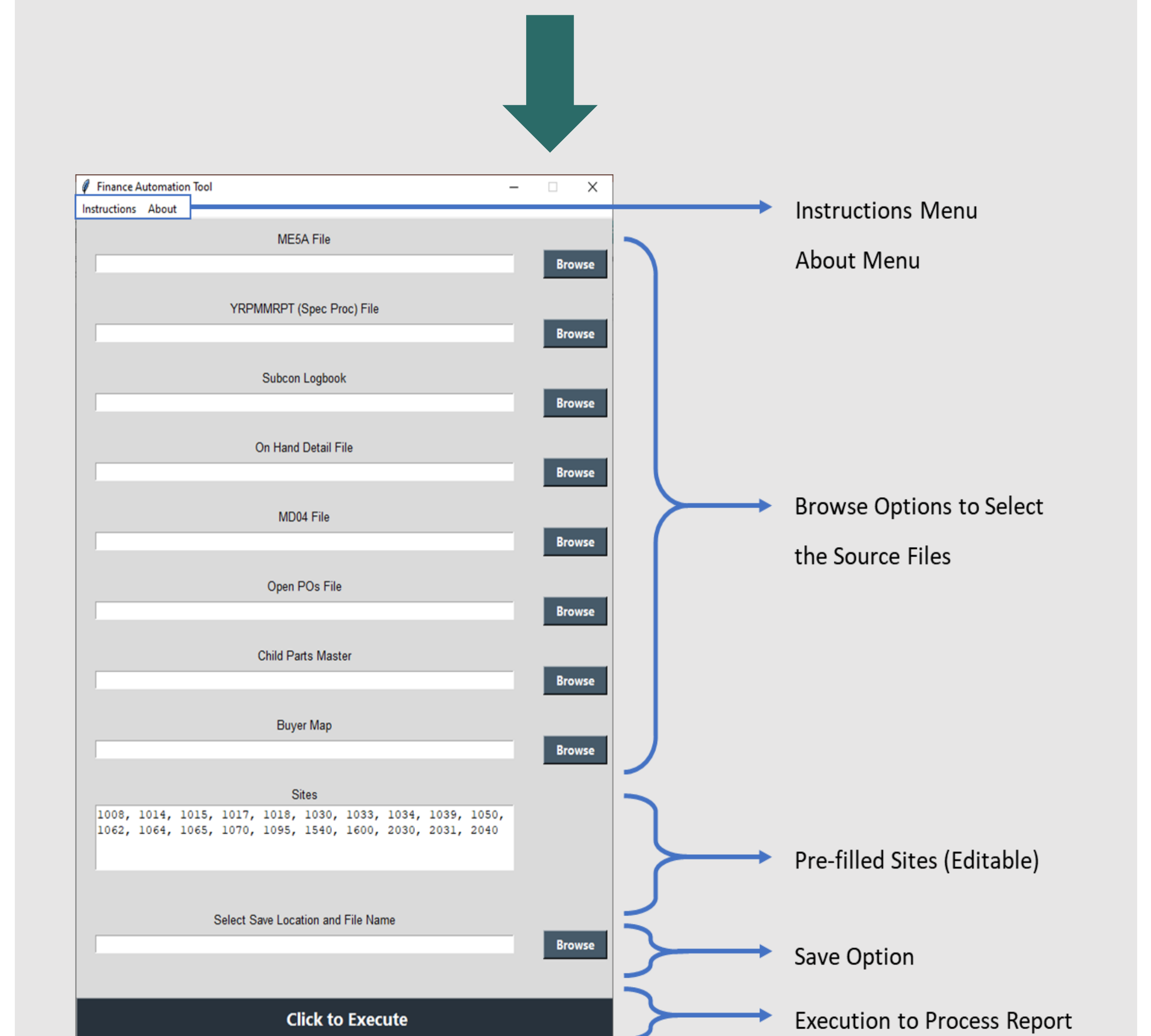- Easy Installation process

- Instructions Menu
- About Menu
- Browse Options to Select the Source Files
- Pre-filled Sites (Editable)
- Save Option
- Execution to Process Report

Figure 3. Final Product

References

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