

A Project Report on

Robotic Process Automation of Supply Chain Management for Healthcare

Submitted in partial fulfillment of the requirements for the award
of the degree of

Bachelor of Engineering

in

Information Technology

by

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Declaration

We declare that this written submission represents our ideas in our own words and where others' ideas or words have been included, We have adequately cited and referenced the original sources. We also declare that We have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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Abstract

Nowadays, the need for systematic deliverance of the healthcare sector is much sought-after. Such, that a simple delay in restocking of certain medicines or supplies could create unrest among the mass, and result in the loss of healthcare facilities for many. Robotic Process Automation (RPA) is a software technology that can create, deploy, and manage bots that emulate certain human actions interacting with digital systems and software. Robotic Process Automation is one of the technologies that can be used to carry out the smooth sailing of the supply chain process. This paper will describe how RPA technology can be used to emulate the various processes in the supply chain management for a healthcare entity, such as checking inventory, reading and comparing vendor quotations, and finalizing a supply vendor.

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List of Abbreviations

| | |
|------|----------------------------|
| RPA: | Robotic Process Automation |
| SCM: | Supply Chain Management |
| IM: | Inventory Management |
| BOT: | Build–operate–transfer |

Chapter 1

Introduction

The supply chain of a pharmaceutical entity is the means through which medicines and medical supplies are manufactured and made available to the patients. The traditional Supply Chain of the Healthcare industry involves raw material suppliers who supply raw material to the manufacturers for drug generation, packaging, and supplying to the distributors. The manufacturer maintains an inventory of drugs for smooth operations. The hospital's pharmacy or a retail pharmacy places an order to a distributor for stocking and restocking their inventory, based on the daily requirement.

In a healthcare environment, inventory refers to the medications and all the medical supplies used in its daily operation. A healthcare entity is required to ensure an adequate stock of medicines and medical supplies are available at all times to better serve the needs of their patients. An effective inventory management process should also contribute to the profitability of the entity. There are two goals of an efficient inventory management process. The first is to ensure medications are available whenever the patients need them. Optimal efforts should be made to always keep the medications used in stock and restock them before they go out-of-stock or get outdated and damaged. The second goal is to contribute to the overall profitability of the entity. The focus should be on being of service to the patients while also keeping the purchase costs of the medications at a minimum.

Robotic Process Automation is a business process automation technology that allows an individual or an organization to define a set of instructions for a software robots or 'bots' to perform. These bots mimic the way humans interact with software to perform high-volume, repeatable tasks. With the help of RPA, we can automate repetitive tasks such as checking inventory and reordering supplies and decisive processes such as reading and comparing vendor quotations and finalizing a supply vendor. This automation incorporated within the system will make it less prone to errors as well as less time-consuming.

Blue Prism is an RPA Tool that provides a virtual workforce to the organizations. It helps organizations to automate manual, repetitive, and rule-based business processes in an agile and cost-effective manner. It includes drag and drop support to automate the tasks. Some features of Blue Prism include: 1) It is platform-independent so that it can be used on any platform. 2) It contains robust features like load balancing, data encryption, and end-to-end auditing. Thus, every change is audited. 3) Blue Prism also supports automation of codes written in Mainframe, Java, Windows applications, and even web-based applications. 4) It supports all major cloud platforms, like Microsoft Azure and Amazon AWS. So, users can manage most of the tasks centrally.

Some advantages of the RPA include:

1. **Cost Savings:-** RPA helps organizations to save a huge amount of cost as it is typically cheaper than hiring an employee to perform the same set of tasks.
2. **Less Error:-** It works on standard logic and does not get bored, distracted, or tired. Hence, the probability of making errors reduces to a great extent, which means less re-work and an enhanced reputation for efficiency.
3. **Faster Processing:-** It works faster than human employees as computer software does not need breaks, food, rest, etc., and can perform repetitive operations tirelessly.

Chapter 2

Literature Review

In this paper [5], the author study aims at the current state of Robotic Process Automation and also recognizes the scientific and industrial literature existing gaps. Here author introduces 54 primary studies analysis which defines the RPA's current state of art. And specifies how these primary studies were selected based on systematic review. Also, the author reviews 14 commercial RPA tools based on 48 functionalities defined. The conclusion of the study is that certain phases except the Analysis phase are covered in majority of the tools and how the shortage of automation in such a phase reflects the technological solutions. Based on this, the author has described some challenges and future directions.

The [6] case study describes how software bots can change our daily life and how the Supply Chain Management process can be impacted once the concept of Robotics comes into the picture. This study describes the different home use cases and day-to-day chores where robotic automation can be used. The author also discusses how RPA has the ability to change the supply chain procedure and eliminate the way of retailing, transporting, and warehousing goods. Process standardization, IT support, the flexibility of the solution, stakeholder expectations, and employee engagement are some of the challenges that might come in the future while implementing RPA in the field of the supply chain.

In this literature [7], the author has given a detailed overview of Robotic Process Automation (RPA). As a result of its increasing popularity, several sectors such as HR, Manufacturing Retail, Telecom, Healthcare, Insurance, Travel and logistic, Banking Financial services, Government Infrastructure have started using RPA. RPA tools offer four phases of deployment: i) Assisted Automation, ii) Unassisted Automation, iii) Cognitive RPA, and iv) Autonomous RPA. The author has given a detailed comparison of the three major RPA tools - Automation Anywhere, Blue Prism, and UiPath, out of which UiPath is the most popular tool. Decreasing turn-around-time up to 80less time consumption of routine tasks, and proper maintenance of system logs for ISO and auditing purposes are a few of the benefits RPA offers.

In the [8] case study, we reviewed the process model regarding how software testing automation allows us to accomplish the testing process in a faster way than compared to the traditional software testing process. This study differentiates Selenium web Driver and Work Fusion, which are the two methodologies of the software test automation with the new RPA based method. This study recommends combining the test scripts written in different programming languages with the RPA solution for performance improvement, less usage of resources, and making the tests more efficient, reliable, and accurate.

RPA has proven itself to be capable of performing and completing high volume processes

which consist of redundant as well as tedious steps. In the research [9], RPA is used to automate the repetitive task of filling out and reading Google forms and input the information filled out in the form, onto a spreadsheet, for educational workshops. Since the software bots follow the exact steps and instructions given to them initially, RPA can effectively perform redundant tasks repetitively without leaving any room for human error.

Chapter 3

Objectives

1. **To automate inventory management System.**
2. **To maintain the adequate stocks of medications:-** Ensuring there is adequate stock of medications available in the inventory is one of the prime motivations behind the need for efficient management of inventory. The quantity of any given medicine in the inventory should neither be too much that it expires before being sold and nor too little that it's unavailable when needed.
3. **To minimize the occurrence of unexpected out-of-stock scenarios resulting from depletion or expiration of inventory:-** The occurrence of situations where the stock of the required medication is not available or the medicines in stock are expired should be minimized to decrease the impact on patient care.
4. **To automate vendor selection Process.**
5. **To automate vendor On Boarding Process.**
6. **To contribute to the overall profitability of healthcare organizations by focusing on purchasing products at the lowest cost:-** The goal is to decrease the total costs to the pharmacy and health care organization by focusing on purchasing products with the lowest price, thus resulting in a profit to the organization. This can be achieved by selecting a vendor that helps keep the acquisition costs as low as reasonably possible.

Chapter 4

Project Design

Project design is an early phase of the project life-cycle where ideas, processes, resources, and deliverable are planned out. A project design comes before a project plan as it's a broad overview whereas a project plan includes more detailed information. There are seven steps involved when creating a project design, including defining goals and using a visual aid to communicate objectives. These visual elements include a variety of methods such as Gantt charts, Kanban boards, and flowcharts. Providing a visual representation of your project strategy can help create transparency between stakeholders and clarify different aspects of the project, including its overall feasibility.

4.1 Existing System

The existing supply chain management framework has mostly relied on the personnel or a group of people handling the system. Also, none of them have a clear idea for the entire product journey as the process flow and teams are isolated. The processes of vendor selection and management of inventory are handled manually. Here, personnel responsible for Vendor Selection reads all the quotations received from the various vendors and compares them based on single or multiple criteria. The vendor with the best offer is selected, and the personnel updates it on the dashboard. Another personnel responsible for Inventory Management carries out the tasks of checking the inventory and keeping track of the quantities of the items in stock to determine what medicines or products to order. When the quantity of a product falls below a specified threshold, the personnel manually add it to the list of products to be restocked. Upon receiving the order from the vendor, this personnel again updates the quantity of the item in the database. One of the drawbacks of such a system is that it's more vulnerable to human errors. The team members need to make multiple phone calls or scan through the long email threads to get the desired information which results in ongoing inefficiencies. A minor mistake or negligence by the person handling the system could affect both- the enterprise and its patients/customers. Also not all the incorrectness are being captured and fixed in a timely manner. Another drawback of the current system is that it's time-consuming. Certain processes, such as checking inventory, reading and comparing vendor quotations, and finalizing a supply vendor require more attention to details. Thus, the execution of such tasks takes more time when carried out by a human. Instead of spending hours doing repetitive tasks it can be automated for greater accuracy and ability.

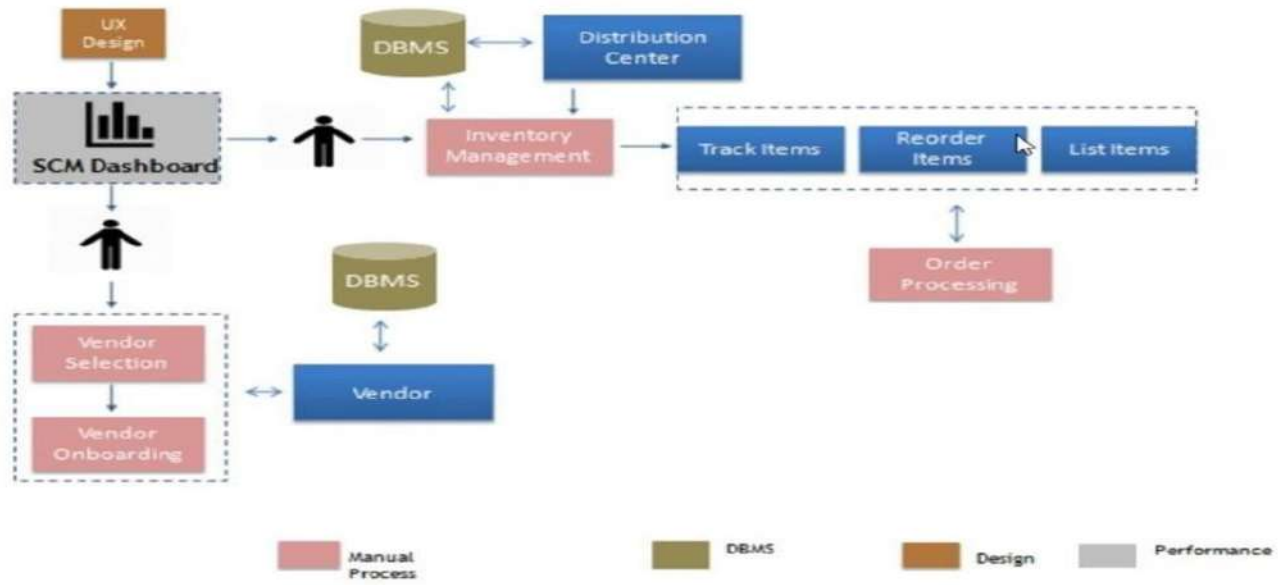


Figure 4.1: Existing System Architecture

4.2 Proposed System

We propose a novel system where software bots will be programmed to carry out processes such as vendor selection, vendor on-boarding, inventory management, and order processing which were previously carried out manually. In other words, the repetitive and time-consuming processes of the Supply Chain Management will be automated with the help of Robotic Process Automation (RPA). The incorporation of this automation within the system will make it less prone to errors as well as less time-consuming. Thus, this new proposed system will lead to increased productivity and throughput. With the help of RPA platform, we create a centralized location to connect all systems which can help the team members to access the required information. So team members can easily get real-time data and overcomes the disadvantage of the existing system of searching for a particular data from the record book. The vendor selection and on-boarding processes will take place when the tenure current supplier terminates. The vendor selection procedure compares the quotations given by several candidate vendors and selects the deal with the best terms. The on-boarding process will finalize the vendor selected, and make changes in the system and database accordingly. The inventory management and order processing procedures of the system are executed on a daily basis. The inventory management automation keeps a track of the pharmacy's inventory. When the available quantity of any medical product goes below its threshold value, the system will send an email to the supplier regarding the restocking of supplies. Upon receiving an 'Order Confirmed' or 'Order Delivered' email from the supplier, the order processing automation will make the necessary changes in the inventory database. The automation minimizes the time, effort, waste and labor cost and maximize s the productivity and financial improvements.

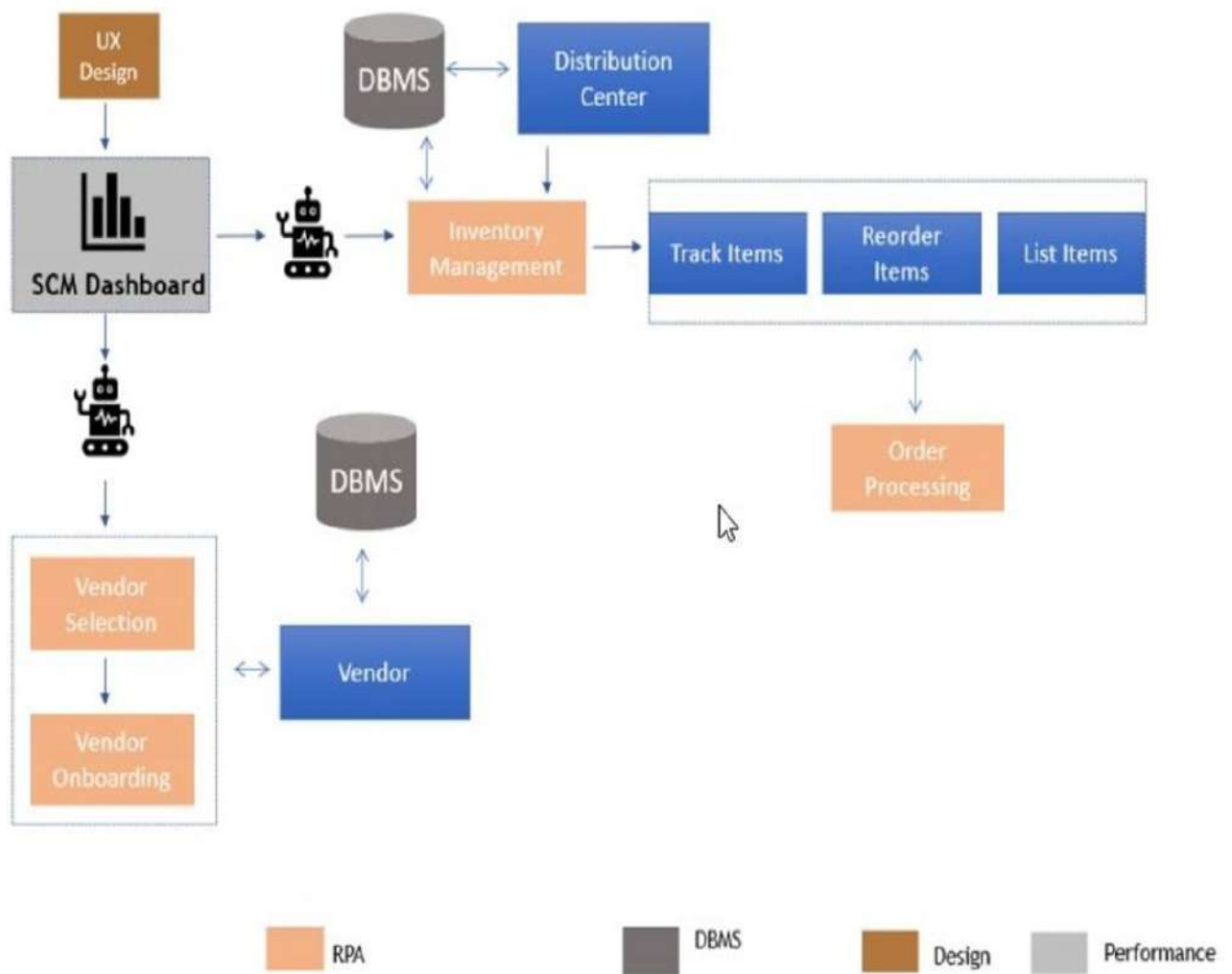


Figure 4.2: Existing System Architecture

4.3 UML Diagrams

UML is a standard language for specifying, visualizing, constructing, and documenting the artifacts of software systems. UML was created by the Object Management Group (OMG) and UML 1.0 specification draft was proposed to the OMG in January 1997. OMG is continuously making efforts to create a truly industry standard. UML stands for Unified Modeling Language. UML is different from the other common programming languages such as C++, Java, COBOL, etc. UML is a pictorial language used to make software blueprints. UML can be described as a general purpose visual modeling language to visualize, specify, construct, and document software system. Although UML is generally used to model software systems, it is not limited within this boundary. It is also used to model non-software systems as well. For example, the process flow in a manufacturing unit, etc. UML is not a programming language but tools can be used to generate code in various languages using UML diagrams. UML has a direct relation with object oriented analysis and design. After some standardization, UML has become an OMG standard.

4.3.1 Use Case Diagram

In the Unified Modeling Language (UML), a use case diagram can summarize the details of your system's users (also known as actors) and their interactions with the system. To build one, you'll use a set of specialized symbols and connectors. An effective use case diagram can help your team discuss and represent:

- Scenarios in which your system or application interacts with people, organizations, or external systems

- Goals that your system or application helps those entities (known as actors) achieve

- The scope of your system

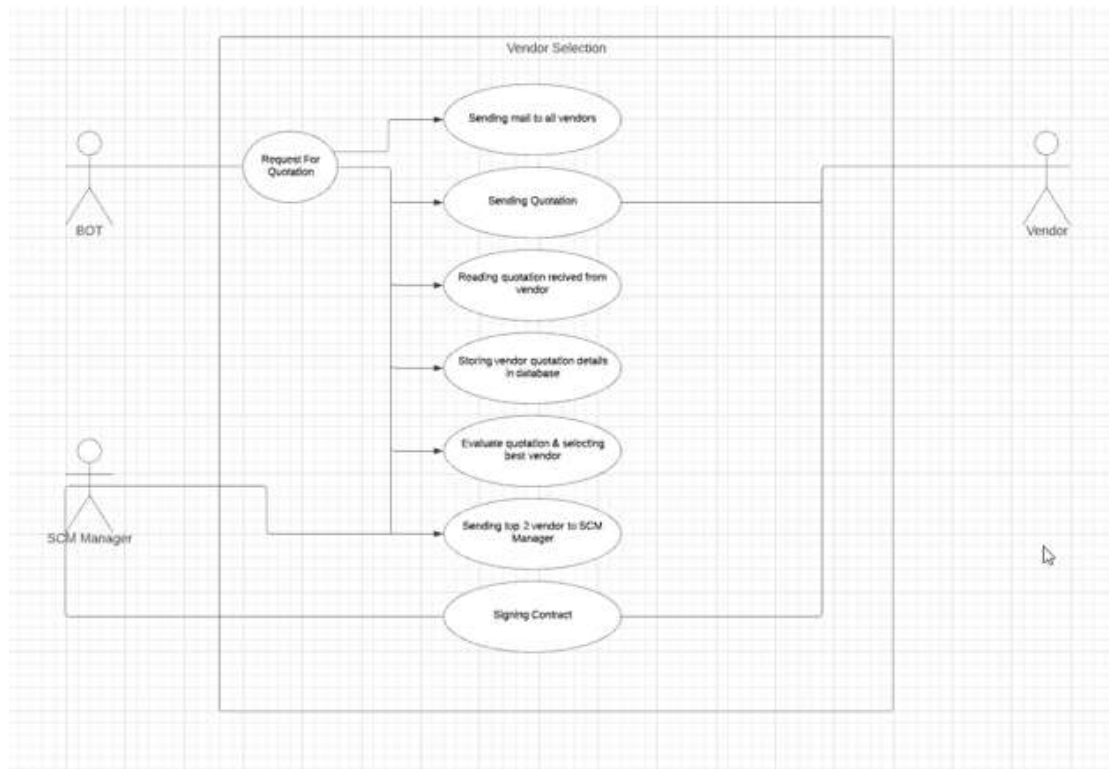


Figure 4.3: Use Case Diagram for Vendor Selection

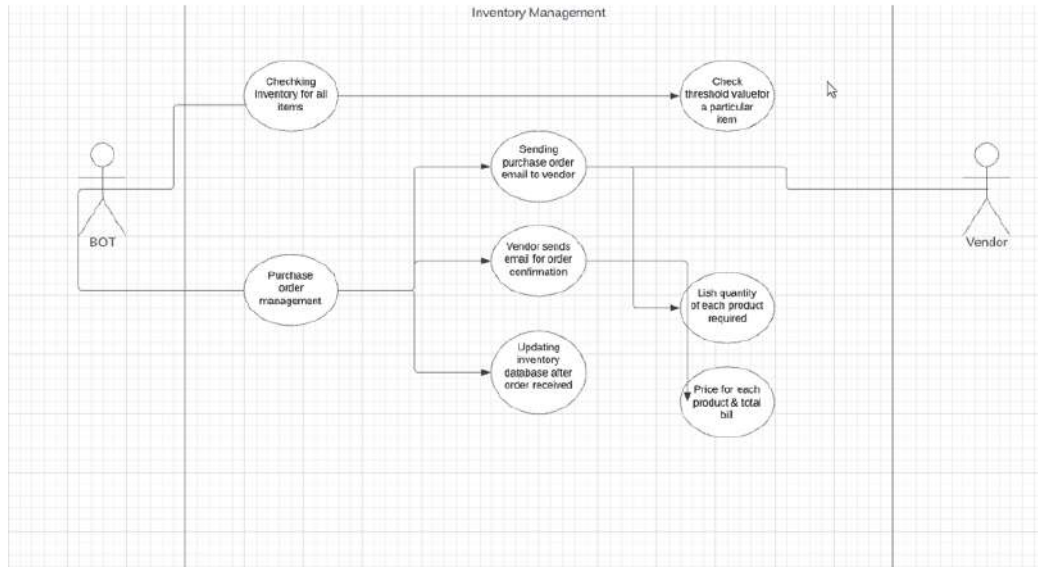


Figure 4.4: Use Case Diagram for Inventory Management

4.3.2 Activity Diagrams

Activity diagram is basically a flowchart to represent the flow from one activity to another activity. Activity diagrams deal with all type of flow control by using different elements such as fork, join, etc. UML is extremely useful for visualizing and documenting software systems, but the terminology can be somewhat overwhelming for someone unfamiliar with UML. An activity diagram is essentially a flowchart that shows activities performed by a system.

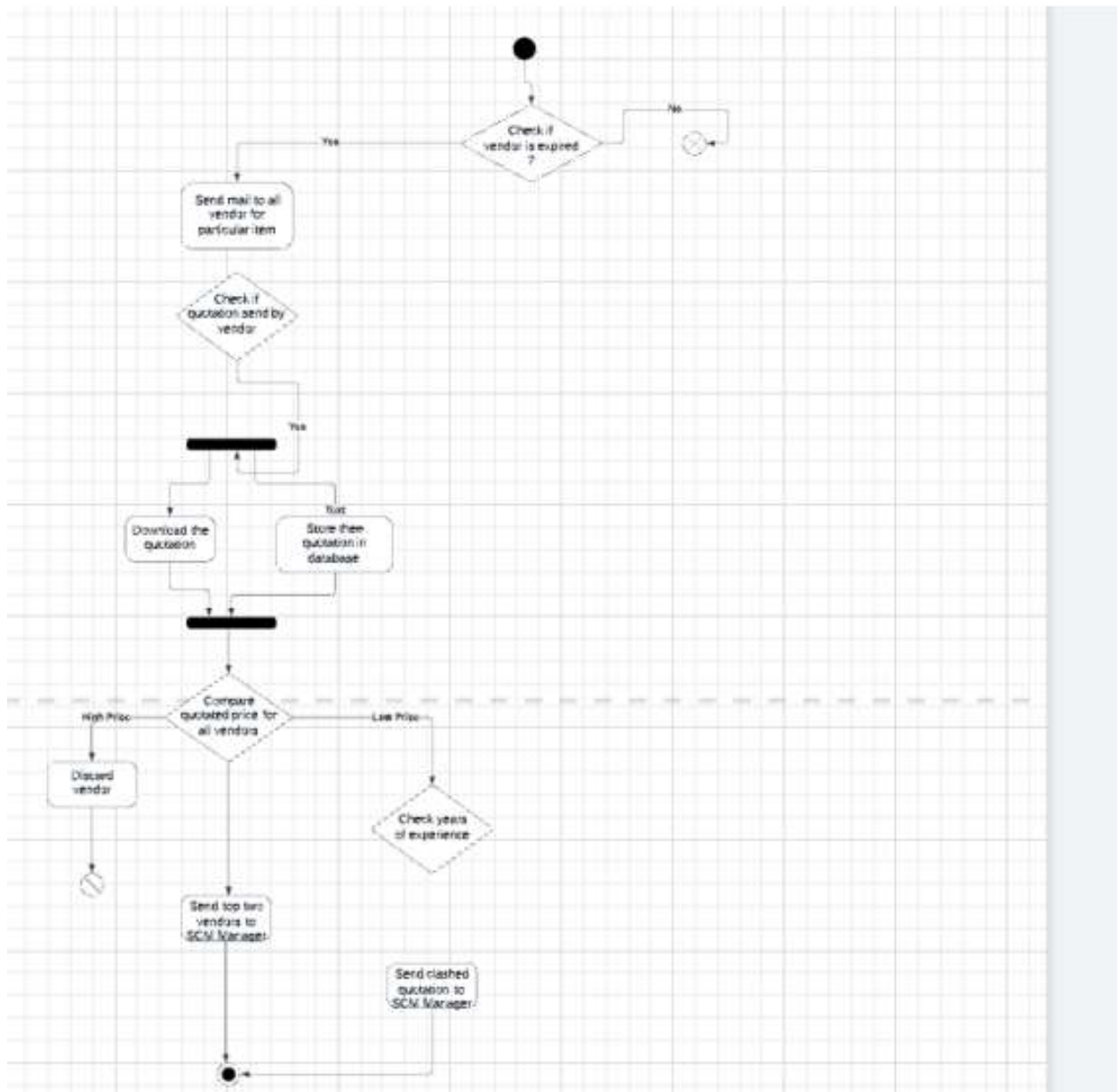


Figure 4.5: Activity Diagram

Chapter 5

Project Implementation

Project implementation (or project execution) is the phase where visions and plans become reality. This is the logical conclusion, after evaluating, deciding, visioning, planning, applying for funds and finding the financial resources of a project. The implementation of projects in sustainable sanitation and water management is complex. It requires the coordination of a wide range of activities, diverse institutional arrangements, and different time frames (DFID 1998). There is not one typical project in water and sanitation, as the actions may vary from the construction of a new infrastructure, to the introduction of new ways of working. Projects in this area cover issues such as: social development, health, environmental sustainability, institutional strengthening, technical implementation, pilot plants, service delivery, social marketing, hygiene promotion, sanitation promotion and capacity building.

It is important to take into account that independently of the nature of the project, implementation takes time, usually more than it is planned, and that many external constraints can appear, which should be considered when initiating the implementation step (i.e. seasonality in availability of community engagement/resources)

5.1 Reading and storing quotations

This process is dedicated to storing all the quotation data from excel files into the database. These quotations are sent to us by the vendors via email. Therefore, prior to running this process we execute another process that downloads all the quotations sent by vendors and save it in one folder. These quotations are excel files with respective vendorid's as the file name. In this process, we iterate through all the files in the folder with the help of MS Excel VBO. First, we store all the data from a file into a BluePrism Collection. Then, the data from the Collection is inserted into the database using Data SQL Server VBO's 'Execute' Action. The resultant table is now ready to be processed for Vendor Selection.

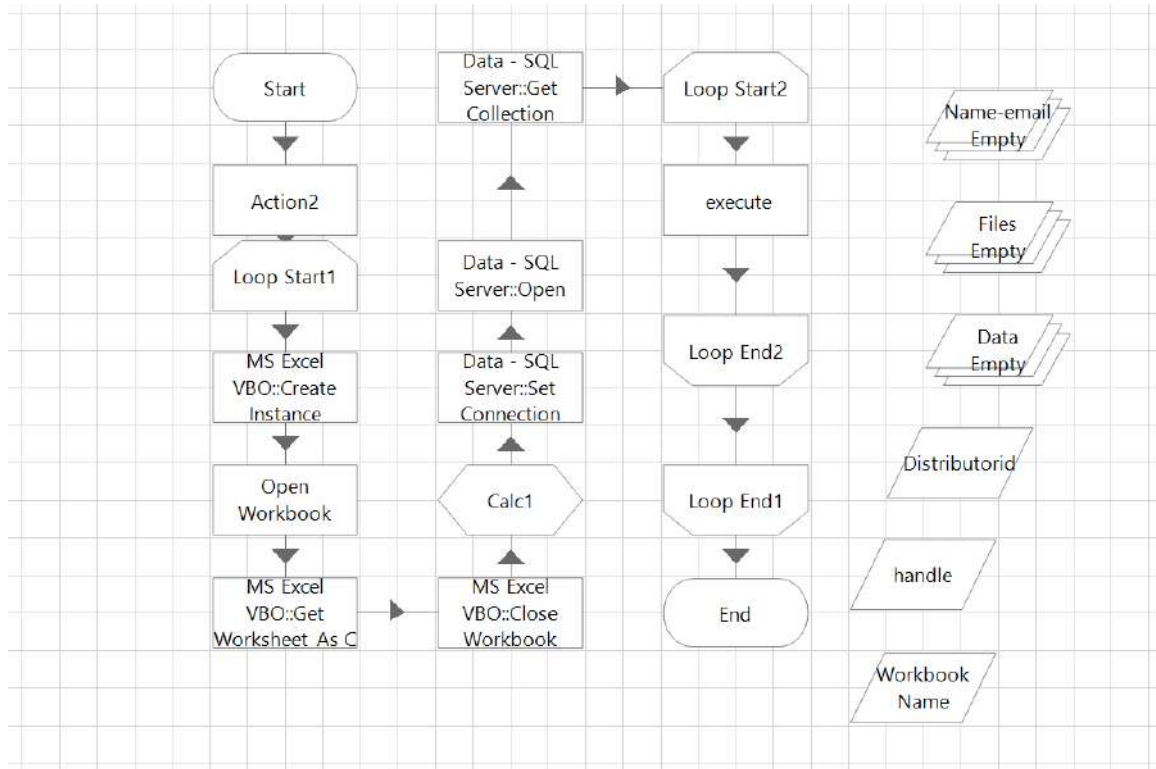


Figure 5.1: Reading and storing quotations

5.2 Updating Inventory when Product Delivered

This process will iterate through the recently received emails of the organization by listing them in a Collection. This is done, with the help of Email POP3/SMTP::List Messages Action. The process will search for emails containing the keywords- 'Order Delivered' in the subject. Upon detecting such an email, the process will again check the subject line of that email for a product name. This product name will be cross-checked with the list of products in the database which were reordered and their delivery was pending. If a match between the product name in the email's subject and database is found, the process increases the current quantity of that product by the number of shipped units and sets the 'ordered' flag to false. (The 'ordered' flag determines whether a particular product's order has already been placed. If the flag is true, then a reorder email for that product has already been sent to the supplier, but order delivery is pending)

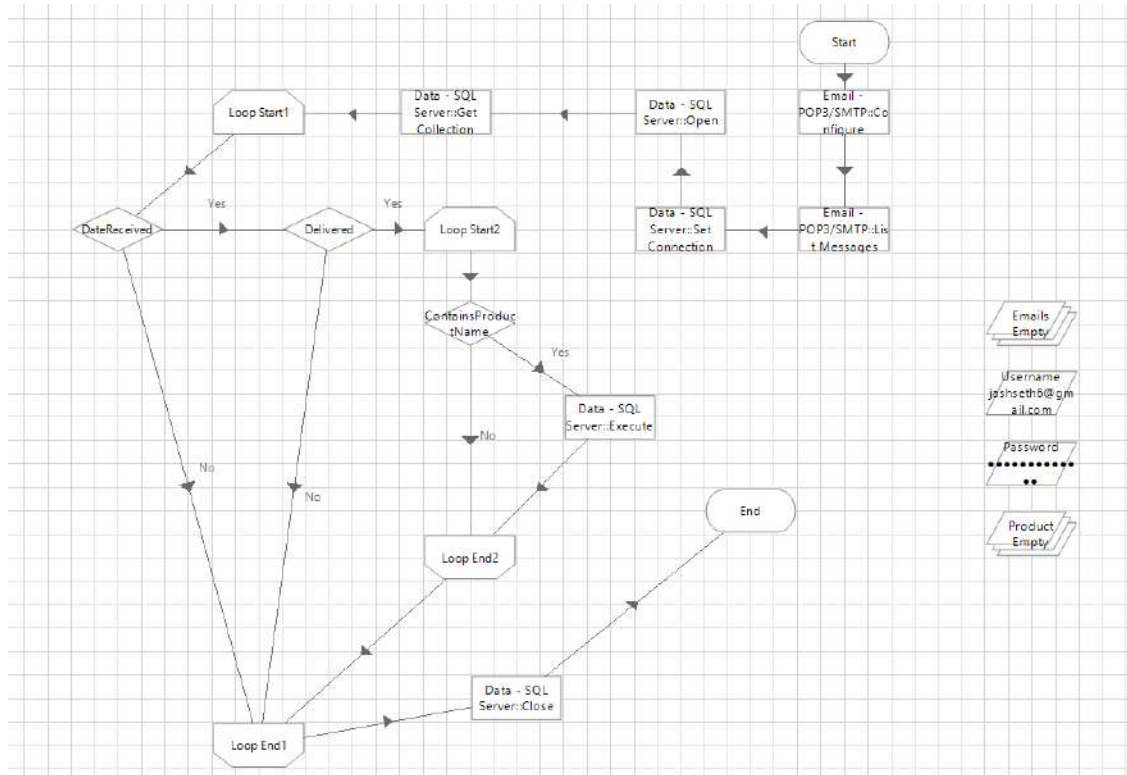


Figure 5.2: Updating Inventory when Product Delivered

5.3 Vendor Selection

The Vendor Selection process is responsible for shortlisting at least 2 best vendor quotations from all the received quotations. The Vendor Selection Algorithm in Code Stage shortlists these candidate vendors by comparing the vendor's quoted-price for the product and experience of the vendor. The details and quotations of the candidate suppliers are sent to the SCM Manager via email. The SCM Manager's job is to reply to that email with the Vendor ID of the candidate that they wish to appoint as the supplier of that product.

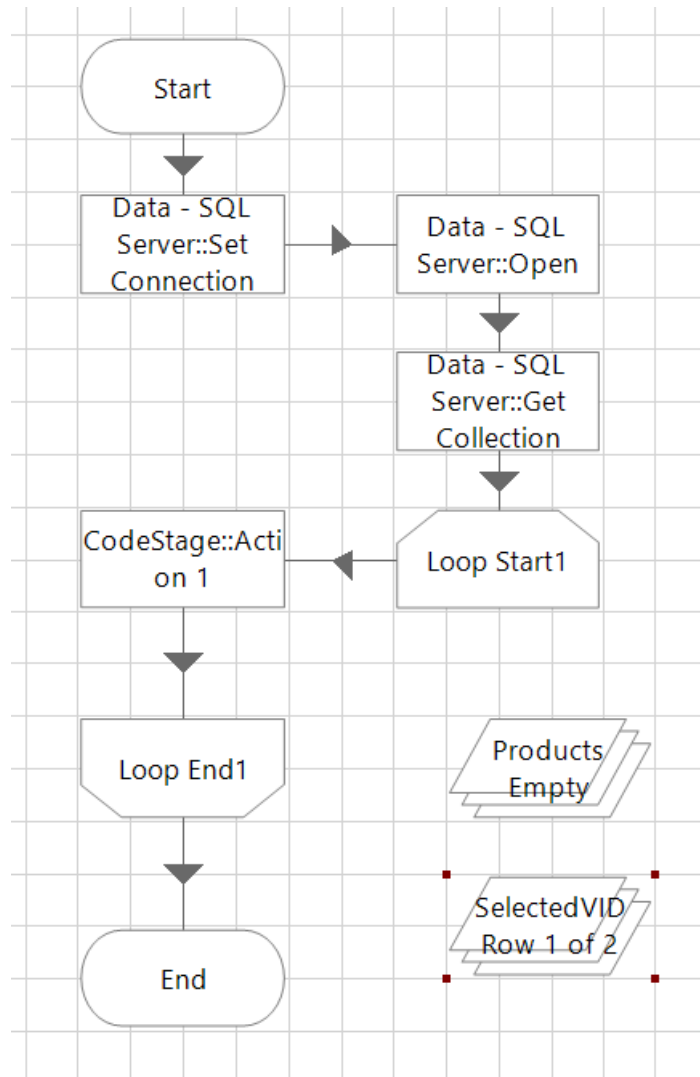


Figure 5.3: Vendor Selection

5.4 Updating Database when Vendor Selected

The Vendor Selection process is responsible for shortlisting at least 2 best vendor quotations from all the received quotations. The Vendor Selection Algorithm in Code Stage shortlists these candidate vendors by comparing the vendor's quoted-price for the product and experience of the vendor. The details and quotations of the candidate suppliers are sent to the SCM Manager via email. The SCM Manager's job is to reply to that email with the Vendor ID of the candidate that they wish to appoint as the supplier of that product.

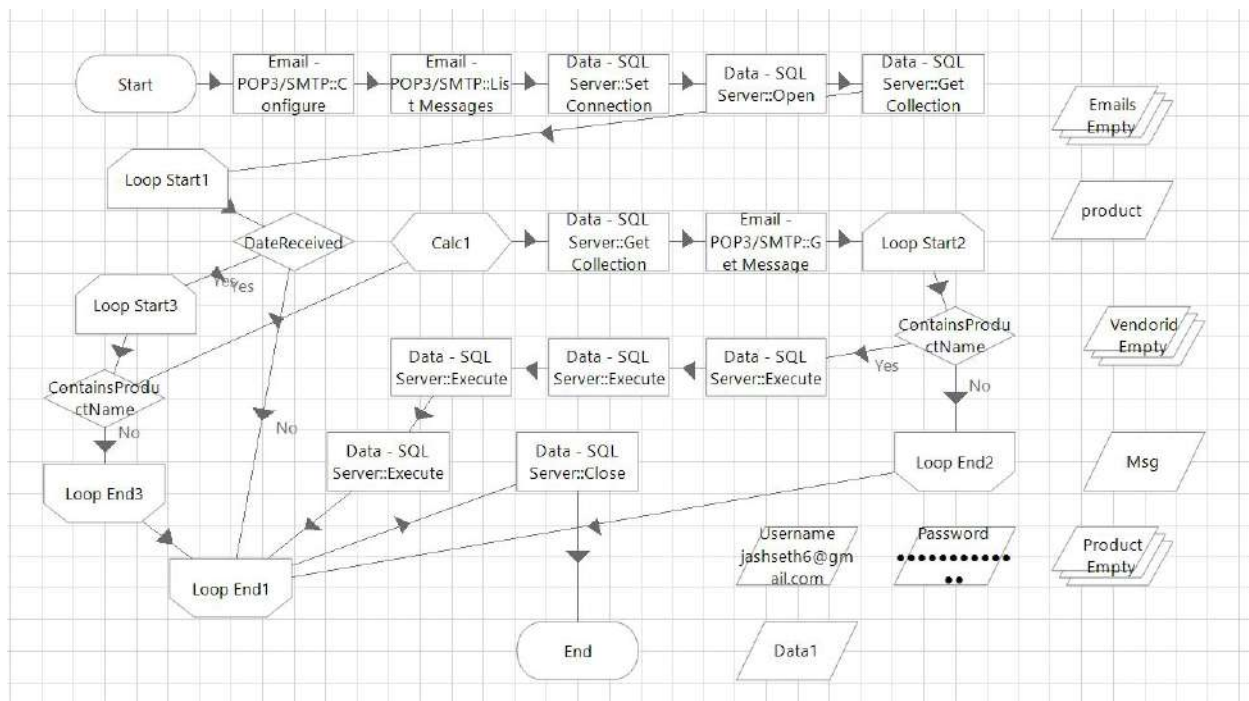


Figure 5.4: Updating Database when Vendor Selected

Chapter 6

Testing

Software Testing is a method to check whether the actual software product matches expected requirements and to ensure that software product is Defect free. It involves execution of software/system components using manual or automated tools to evaluate one or more properties of interest. The purpose of software testing is to identify errors, gaps or missing requirements in contrast to actual requirements.

Some prefer saying Software testing definition as a White Box and Black Box Testing. In simple terms, Software Testing means the Verification of Application Under Test (AUT). This Software Testing course introduces testing software to the audience and justifies the importance of software testing.

6.1 Functional Testing

6.1.1 Unit Testing

Unit testing is the first level of testing and is often performed by the developers themselves. It is the process of ensuring individual components of a piece of software at the code level are functional and work as they were designed to. Developers in a test-driven environment will typically write and run the tests before the software or feature is passed over to the test team. Unit testing can be conducted manually. Unit testing will also make debugging easier because finding issues earlier means they take less time to fix than if they were discovered later in the testing process.

The Unit testing is best suited for our application development phase. In that phase, we started to code in units create different modules. And test each module separately, like the login page, register page, home page, contacts page, emergency screen, analysis page etc. All these pages are tested and debugged before going further integrating. And check whether we are getting the desired output from each module as for the objectives.

6.1.2 Integration Testing

After each unit is thoroughly tested, it is integrated with other units to create modules or components that are designed to perform specific tasks or activities. These are then tested as group through integration testing to ensure whole segments of an application behave as expected (i.e, the interactions between units are seamless). These tests are often framed

by user scenarios, such as logging into an application or opening files. Integrated tests can be conducted by either developers or independent testers and are usually comprised of a combination of automated functional and manual tests.

As we have discussed unit testing the next step is integration testing. All the units which we have tested and debugged are now ready to integrate into a whole single module. The integration part is crucial as we need to know which unit must interact without error, calling them in a different class accessing the instance of that class all these can be cleared with help of the sequence diagram which was represented in Project Design. So accordingly, modules are integrated and checked whether they behave as for the objectives.

6.2 Non Functional Testing

6.2.1 Compatibility Testing

Compatibility testing is used to gauge how an application or piece of software will work in different environments. It is used to check that your product is compatible with multiple operating systems, platforms, browsers, or resolution configurations. The goal is to ensure that your software's functionality is consistently supported across any environment you expect your end-users to be using.

Chapter 7

Result

Result is a thing that is caused or produced by something a consequence or outcome. Project results are the changes or effects expected to take place after implementing the project. The results are generally positive improvements to the lives of the beneficiaries.

Results are divided into three types:

1. Outputs
2. Outcomes
3. Impact

Outputs are immediate results achieved soon after the completion an activity. For example, in a project training locals on human rights, the output might be “20 community workers trained in basic human rights concepts.”

The outcomes are the results achieved after a period of time. These are the short-term effects of the immediate outputs. If after some time a change occurs because of the project activity, it can be called an outcome. Continuing the above example, the outcome might be: “the participants used their training to inform other community members about their human rights.”

The impact is the long-term result that came about because of the activities undertaken in the project. For the above example, the impact of the project might be that one year later, the whole community is aware of human rights issues and in the next election the community largely voted against a leader with a history of human rights violations.

7.1 Placing Order To Vendor

The inventory is checked if any product quantity is less than its threshold value then an ordered is placed to the vendor of that particular product. This is done viva and automated mail and a BOT.

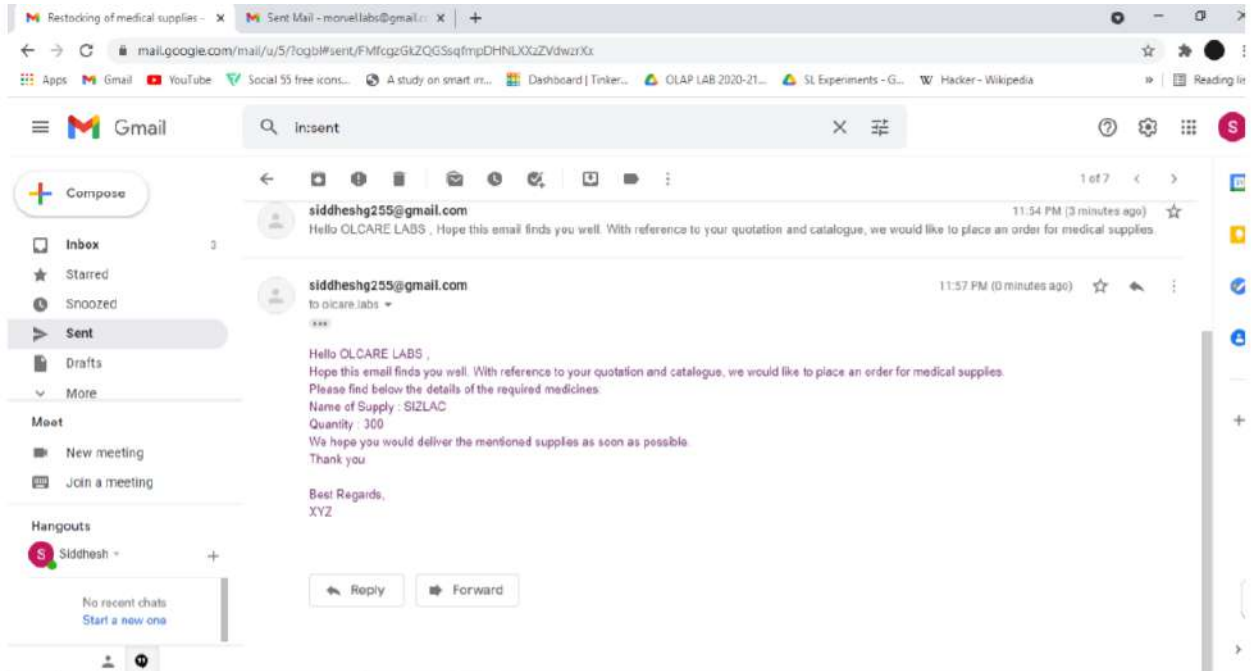
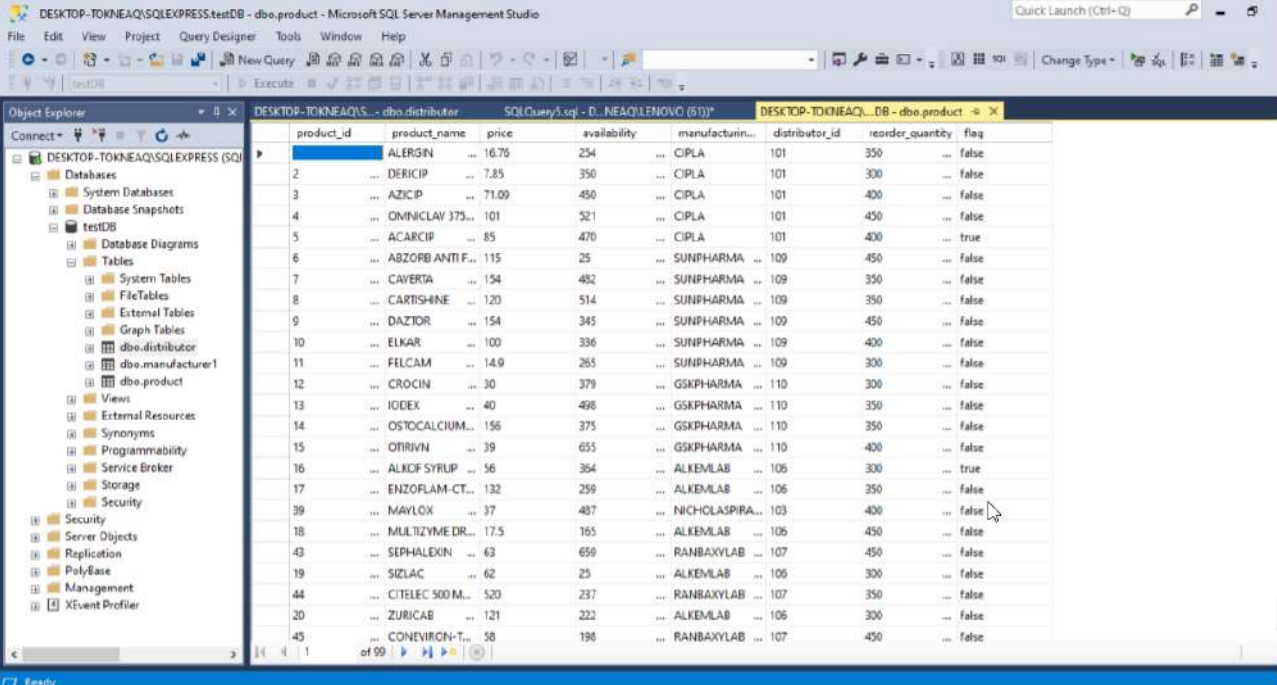


Figure 7.1: Placing Order To Vendor

7.2 Updating the Quantity in Database

Once the order is placed by the Bot to the vendor. The BOT will wait for confirmation from the vendor once the confirmation email is sent the Bot will read the email and update the product quantity in the database.



| product_id | product_name | price | availability | manufacturin... | distributor_id | reorder_quantity | flag |
|------------|------------------|-------|--------------|-----------------|-----------------|------------------|-------|
| 1 | ALERGIN | 16.75 | 254 | ... | CIPLA | 350 | false |
| 2 | DERICIP | 7.85 | 350 | ... | CIPLA | 300 | false |
| 3 | AZICIP | 71.09 | 450 | ... | CIPLA | 400 | false |
| 4 | OMNICLAY 375 | 101 | 521 | ... | CIPLA | 450 | false |
| 5 | ACARCIP | 85 | 470 | ... | CIPLA | 400 | true |
| 6 | ABZORB ANTI F... | 115 | 25 | ... | SUNPHARMA | 450 | false |
| 7 | CAVERTA | 154 | 482 | ... | SUNPHARMA | 350 | false |
| 8 | CARTISHINE | 120 | 514 | ... | SUNPHARMA | 350 | false |
| 9 | DAZTOR | 154 | 345 | ... | SUNPHARMA | 450 | false |
| 10 | ELKAR | 100 | 336 | ... | SUNPHARMA | 400 | false |
| 11 | FELCAM | 14.9 | 265 | ... | SUNPHARMA | 300 | false |
| 12 | CROCIN | 30 | 379 | ... | GSKPHARMA | 300 | false |
| 13 | IODEX | 40 | 498 | ... | GSKPHARMA | 350 | false |
| 14 | OSTOCALCIUM... | 156 | 375 | ... | GSKPHARMA | 350 | false |
| 15 | OTRIVIN | 39 | 655 | ... | GSKPHARMA | 400 | false |
| 16 | ALKOF SYRUP | 56 | 364 | ... | ALKENLAB | 300 | true |
| 17 | ENZOFLAM-CT... | 132 | 259 | ... | ALKENLAB | 350 | false |
| 39 | MAYLOX | 37 | 487 | ... | NICHOLASPIRA... | 400 | false |
| 18 | MULTIZYME DR... | 17.5 | 165 | ... | ALKENLAB | 450 | false |
| 43 | SEPHALEXIN | 63 | 659 | ... | RANBAXYLAB | 450 | false |
| 19 | SIZLAC | 62 | 25 | ... | ALKENLAB | 300 | false |
| 44 | CITELEC 500 M... | 520 | 237 | ... | RANBAXYLAB | 350 | false |
| 20 | ZURICAB | 121 | 222 | ... | ALKENLAB | 300 | false |
| 45 | CONEVIRON-T... | 58 | 198 | ... | RANBAXYLAB | 450 | false |

Figure 7.2: Updated Product Table

7.3 Requesting vendors to send Quotation

When a vendor is expired the system needs to Onboard a new vendor. This task has been automated using bots. In this process the bots asks the vendors the send quotation for one or more products. The bot then reads the quotations.

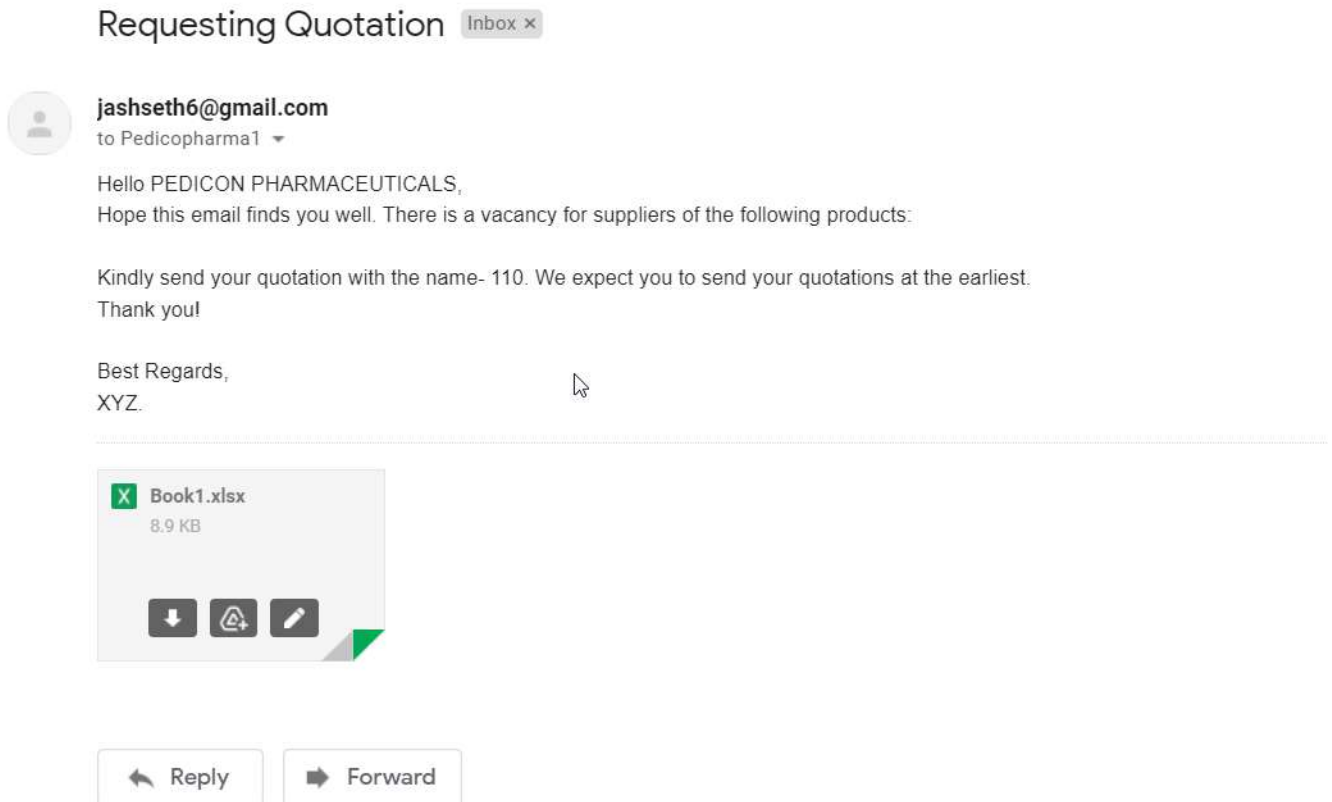



Figure 7.3: Requesting vendors to send Quotation

7.4 Sending best two quotation

When a vendor is expired the system needs to Onboard a new vendor. This task has been automated using bots. In this process the bots asks the vendors the send quotation for one or more products. The bot then reads the quotations and a vendor is being selected based on prices and year of experience automatically. The list of best two vendors is sent to the SCM manager.

Supplier Selection for ALKOF SYRUP Inbox x

 **jashseth6@gmail.com**
to me ▾

Greetings Manager,

Following are the Shortlisted Quotations for ALKOF SYRUP:

| ID | Name | Quoted Price | Experience(years) |
|-----|---------------------|--------------|-------------------|
| 103 | J&J MEDICAL | 25 | 2 |
| 107 | SUNRISE REMEDIES 90 | | 11 |

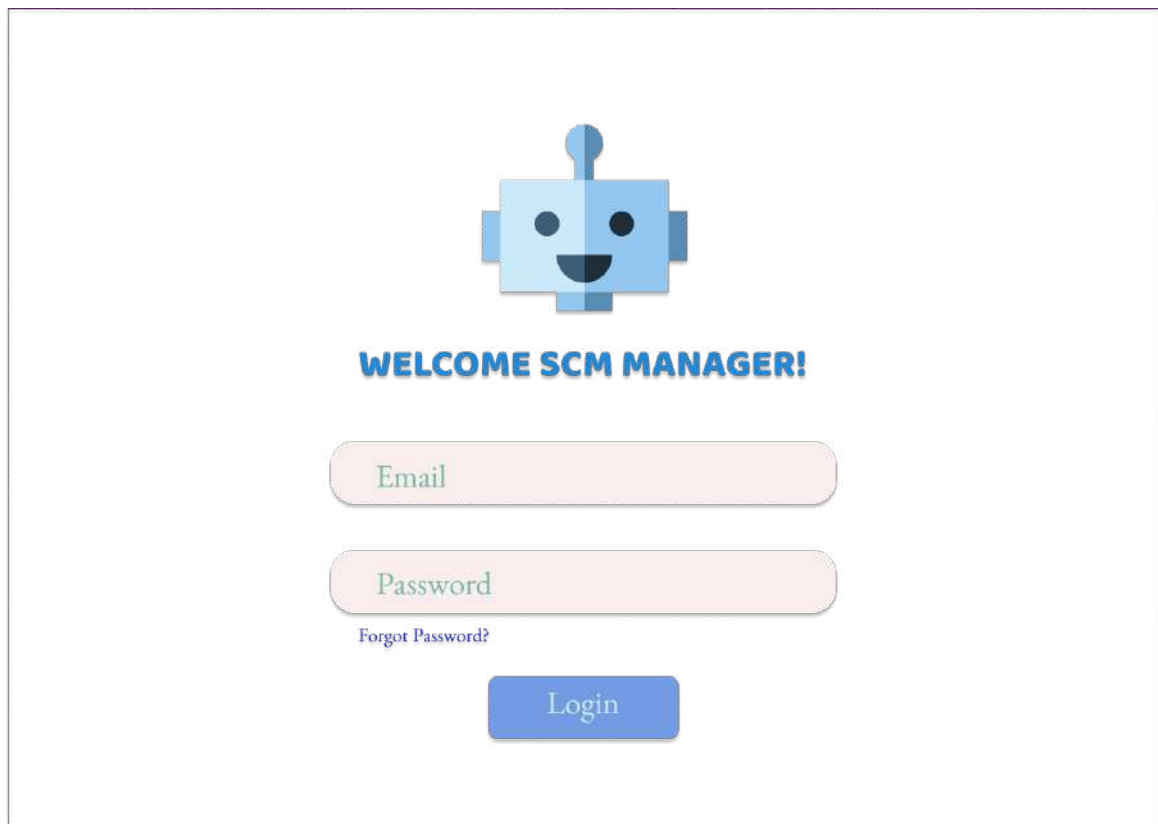
Kindly respond with the ID of the Vendor whose Quotation you wish to selec; followed by the Name of the Product.

↩ Reply ➡ Forward

Figure 7.4: Sending best two quotation

7.5 SCM Manager Login

The SCM Manager needs to login with the credentials to view the dashboard.



The login form for SCM Manager features a blue robot icon at the top. Below the icon is the text "WELCOME SCM MANAGER!". The form includes two input fields: "Email" and "Password", both with light green placeholder text. A link labeled "Forgot Password?" is positioned below the password field. At the bottom of the form is a blue "Login" button.

Figure 7.5: SCM Manager Login

7.6 SCM Manager Dashboard

After successful login, the SCM manager would be able to view the dashboard with three options: check inventory, vendor contracts, and begin vendor selection. Each of the three options, when clicked, will perform their respective processes in BluePrism. The SCM Manager also has the logout option.



Figure 7.6: SCM Manager Dashboard

7.7 Check Inventory

When SCM Manager clicks on the Check Inventory, the process will check the product table and lists all the products which are running on low inventory. The list is displayed on a pop-up like window.

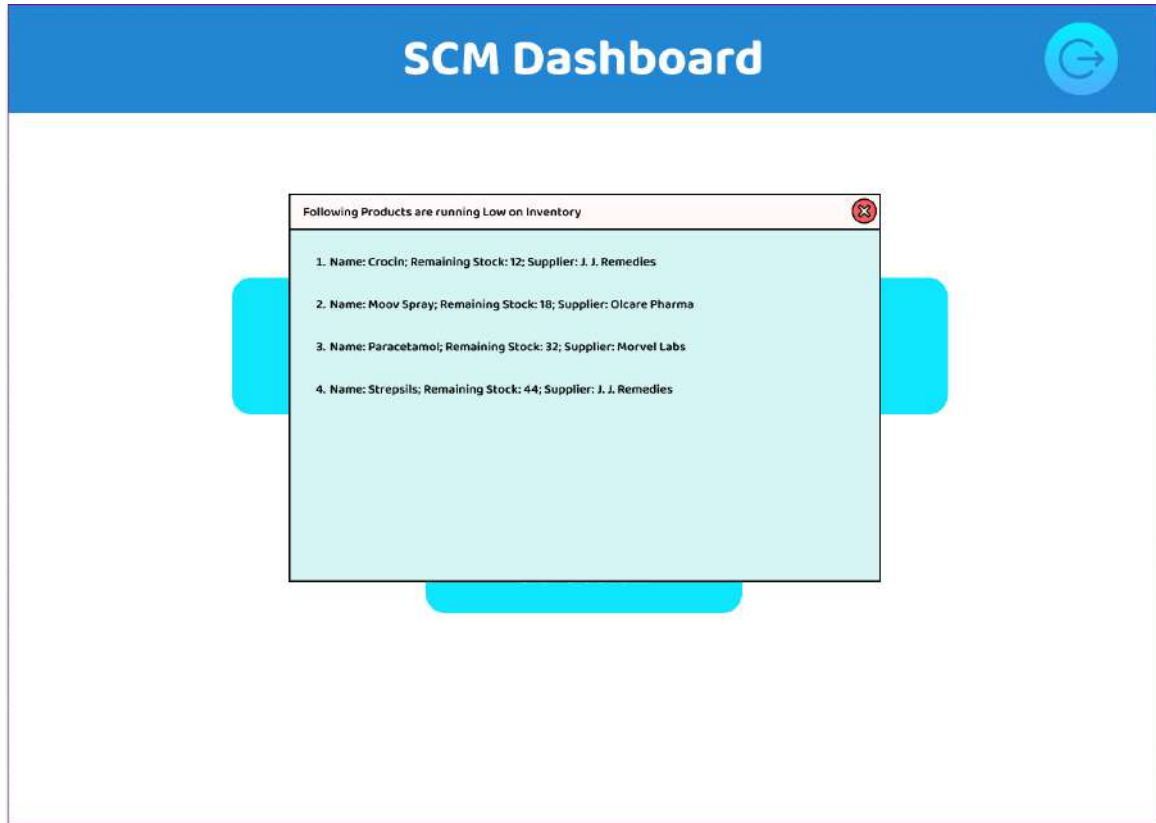


Figure 7.7: Check Inventory

7.8 Vendor Contracts

When SCM Manager clicks on the Vendor Contracts, the process will check distributors table and lists all the vendors whose tenure is expiring by checking the date of expiry. With this, the SCM manager will come to know for which product a particular vendor is expiring and onboard a vendor for that product.

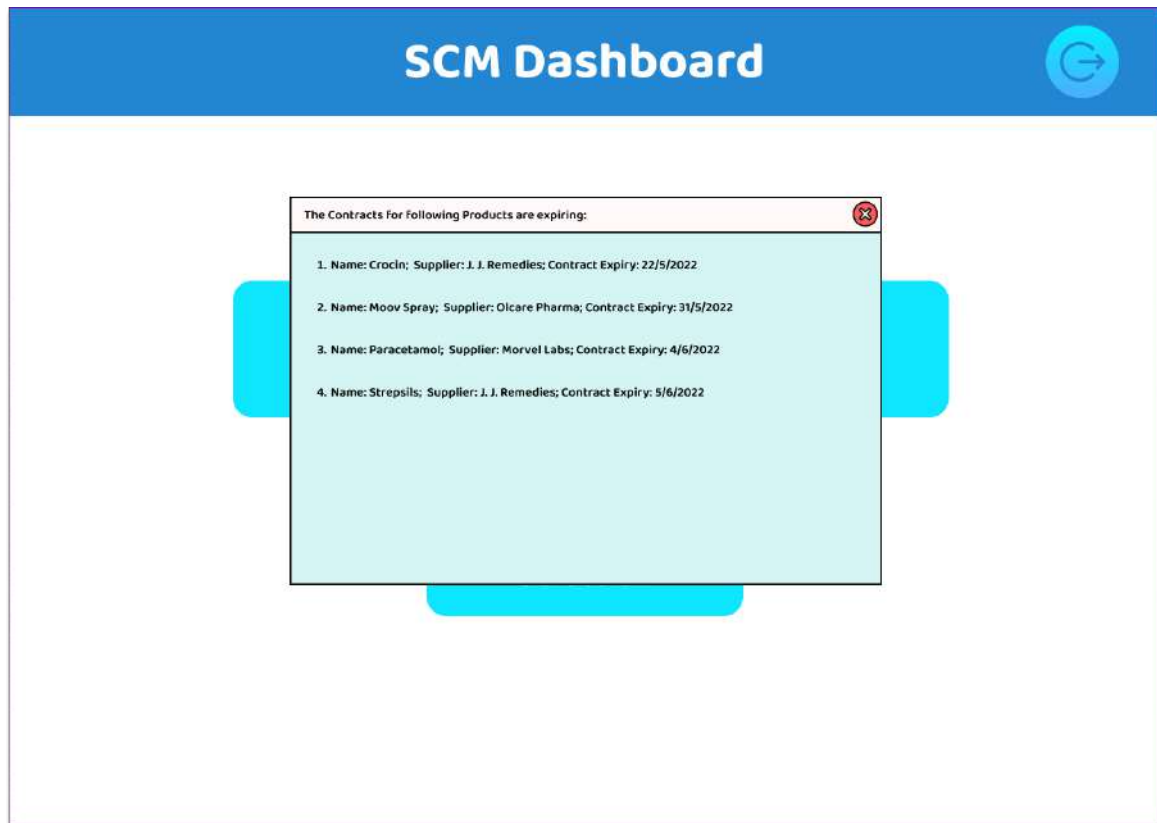


Figure 7.8: Vendor Contracts

7.9 Begin Vendor Selection

When SCM Manager clicks on Begin Vendor Selection, all the processes which are related to vendor selection would run and top two vendors will be selected based on the price of the product and based on the number of experience. Later SCM Manager needs to select one of the top two vendors and needs to make the necessary updates in the database.

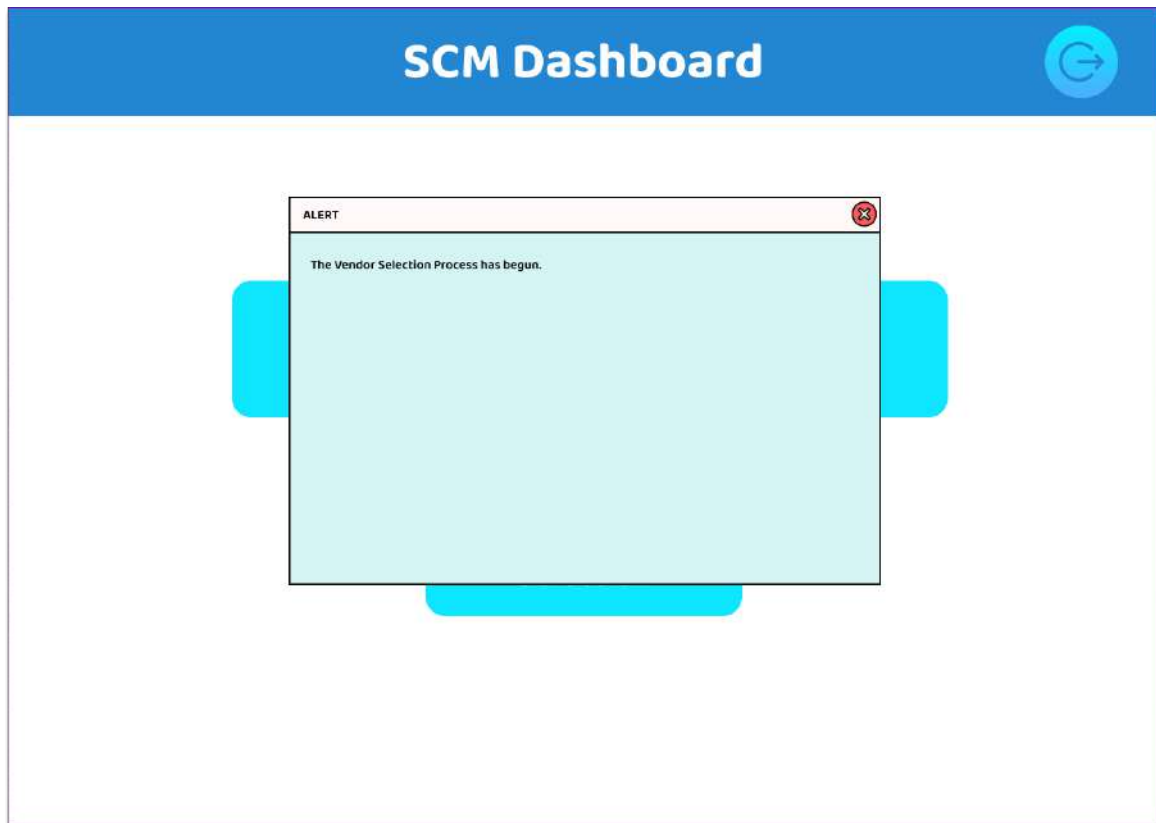


Figure 7.9: Begin Vendor Selection

Chapter 8

Conclusions and Future Scope

The existing supply chain framework has a lot of shortcomings and we believe these are mainly because of the human management of processes. So, we have proposed a novel supply chain management framework in the healthcare sector, using Robotic Process Automation. By programming BOTs to automate certain processes in a system which were previously handled manually, we can overcome the several shortcomings in the supply chain management system, such as frequent human errors, excess delay, inaccuracies, etc. Automating the key processes, such as Vendor Selection, Vendor On boarding, Inventory Management and Order Processing with the help of RPA Tool, can help us make the system more reliable and easier to implement.

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Appendices

Appendix-A: Blue Prism Download and Installation

Step 1. First, we need to navigate to the following link: <https://digitalexchange.blueprism.com/>

Step 2: Then, we will get to the login page, where we need to click on the 'Sign up here' link

Step 3: Then, we will be redirected to a page where we need to fill some basic details, such as email address, name, time-zone, etc. After filling all the required details, we need to click on 'Create New Account'.

Step 4: Once we have submitted the details, we will receive an email with a link. We are required to login to our email account and open that link through the browser.

Step 5: The account will be created, and we need to request a download link using this account. Again, we need to navigate to the following link:

<https://digitalexchange.blueprism.com/site/global/software/index.gsp>

Step 6: On the next screen, we will get two different options for checking the Blue Prism trial version, Cloud and Local. We will be using Blue Prism locally on our system. Therefore, we need to click on the 'Free Download' button under the 'Run locally' tab.

Step 7: Once we click on the 'Free download' button, we will be redirected to a page where we need to click on the 'Get Free Trial'.

Step 8: It will open a new screen where we need to verify and submit our details to request a download link over an email. It is essential to fill up the correct email address because it will be used to send a download link.

Step 9: After submitting the details, we will get another email with a download link. We are required to click on 'Download Blue Prism'

Step 10: Once we click on the download button, the download will start.

Appendix-B: Blue Prism Installation

Step 1: Once the download has finished, we need to double-click on the downloaded file to start the Blue Prism installation.

Step 2: On the next screen, we must acknowledge the terms and conditions and accept the license agreement. We need to click on the radio button and then 'Next' button.

Step 3: After that, we need to select the location where we want to install Blue Prism. We will use the default destination folder and then click on the 'Install' button.

Step 4: After completing the above steps, the installation process will start.

Step 5: Once the installation has finished, we will see the confirmation screen.

Step 6: Now, we need to click on 'Finish and launch Blue Prism'. That is how we can install Blue Prism on the system locally.

Appendix-C: Microsoft SQL Server Management Studio

1. Download Microsoft SQL Server Management Studio from <https://aka.ms/ssmsfullsetup>
2. Unzip rar file and Install it.

Publication

Paper entitled “Automation of Supply Chain Management for Healthcare” is presented at “3RD International Conference on Deep Learning, Artificial Intelligence and Robotics, (ICDLAIR) 2021”

Paper entitled “Automation of Supply Chain Management for Healthcare” is indexed in “Springer Lecture Notes in Networks and Systems”

Automation of Supply Chain Management for Healthcare

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Abstract. Nowadays, the need for systematic deliverance of the healthcare sector is much sought-after. Such, that a simple delay in restocking of certain medicines or supplies could create unrest among the mass, and result in the loss of healthcare facilities for many. Robotic Process Automation (RPA) is a software technology that can create, deploy, and manage bots that emulate certain human actions interacting with digital systems and software. Robotic Process Automation is one of the technologies that can be used to carry out the smooth sailing of the supply chain process. This paper will describe how RPA technology can be used to emulate the various processes in the supply chain management for a healthcare entity, such as checking inventory, reading and comparing vendor quotations, and finalizing a supply vendor.

Keywords: Robotic Process Automation, Supply Chain Management, Inventory Management

1 Introduction

The supply chain of a pharmaceutical entity is the means through which medicines and medical supplies are manufactured and made available to the patients. The traditional Supply Chain of the Healthcare industry involves raw material suppliers who supply raw material to the manufacturers for drug generation, packaging, and supplying to the distributors. The manufacturer maintains an inventory of drugs for smooth operations. The hospital's pharmacy or a retail pharmacy places an order to a distributor for stocking and restocking their inventory, based on the daily requirement.

In a healthcare environment, inventory refers to the medications and all the medical supplies used in its daily operation. A healthcare entity is required to ensure an adequate stock of medicines and medical supplies are available at all times to better serve the needs of their patients. An effective inventory management process should also contribute to the profitability of the entity. There

are two goals of an efficient inventory management process. The first is to ensure medications are available whenever the patients need them. Optimal efforts should be made to always keep the medications used in stock and restock them before they go out-of-stock or get outdated and damaged. The second goal is to contribute to the overall profitability of the entity. The focus should be on being of service to the patients while also keeping the purchase costs of the medications at a minimum.

Robotic Process Automation is a business process automation technology that allows an individual or an organization to define a set of instructions for a software robots or 'bots' to perform. These bots mimic the way humans interact with software to perform high-volume, repeatable tasks. With the help of RPA, we can automate repetitive tasks such as checking inventory and reordering supplies and decisive processes such as reading and comparing vendor quotations and finalizing a supply vendor. This automation incorporated within the system will make it less prone to errors as well as less time-consuming.

Blue Prism is an RPA Tool that provides a virtual workforce to the organizations. It helps organizations to automate manual, repetitive, and rule-based business processes in an agile and cost-effective manner. It includes drag and drop support to automate the tasks. Some features of Blue Prism include:

- 1) It is platform-independent so that it can be used on any platform.
- 2) It contains robust features like load balancing, data encryption, and end-to-end auditing. Thus, every change is audited.
- 3) Blue Prism also supports automation of codes written in Mainframe, Java, Windows applications, and even web-based applications.
- 4) It supports all major cloud platforms, like Microsoft Azure and Amazon AWS. So, users can manage most of the tasks centrally.

Some advantages of the RPA include:

Cost Savings:- RPA helps organizations to save a huge amount of cost as it is typically cheaper than hiring an employee to perform the same set of tasks. **Less Error:-** It works on standard logic and does not get bored, distracted, or tired. Hence, the probability of making errors reduces to a great extent, which means less re-work and an enhanced reputation for efficiency.

Faster Processing:- It works faster than human employees as computer software does not need breaks, food, rest, etc., and can perform repetitive operations tirelessly. With RPA, processing time becomes predictable and consistent, which ensures high-quality customer service across the operations.

The organisation of this paper from hereafter is as follows: Section 2 contains the Literature Survey done and Section 3 presents the Objectives of the proposed system. Then Section 4 describes the Existing System Architecture, methods and the solution to that is shown in the Proposed System Architecture in Section 5. Section 6 contains Conclusion and Section 7 has Acknowledgment.

2 Literature Review

In this paper [5], the author study aims at the current state of Robotic Process Automation and also recognizes the scientific and industrial literature existing gaps. Here author introduces 54 primary studies analysis which defines the RPA's current state of art. And specifies how these primary studies were selected based on systematic review. Also, the author reviews 14 commercial RPA tools based on 48 functionalities defined. The conclusion of the study is that certain phases except the Analysis phase are covered in majority of the tools and how the shortage of automation in such a phase reflects the technological solutions. Based on this, the author has described some challenges and future directions.

The [6] case study describes how software bots can change our daily life and how the Supply Chain Management process can be impacted once the concept of Robotics comes into the picture. This study describes the different home usecases and day-to-day chores where robotic automation can be used. The author also discusses how RPA has the ability to change the supply chain procedure and eliminate the way of retailing, transporting, and warehousing goods. Process standardization, IT support, the flexibility of the solution, stakeholder expectations, and employee engagement are some of the challenges that might come in the future while implementing RPA in the field of the supply chain.

In this literature [7], the author has given a detailed overview of Robotic Process Automation (RPA). As a result of its increasing popularity, several sectors such as HR, Manufacturing & Retail, Telecom, Healthcare, Insurance, Travel and logistic, Banking & financial services, Government & Infrastructure have started using RPA. RPA tools offer four phases of deployment: i) Assisted Automation, ii) Unassisted Automation, iii) Cognitive RPA, and iv) Autonomous RPA. The author has given a detailed comparison of the three major RPA tools - Automation Anywhere, Blue Prism, and UiPath, out of which UiPath is the most popular tool. Decreasing turn-around-time up to 80%,-30% cost reduction, less time consumption of routine tasks, and proper maintenance of system logs for ISO and auditing purposes are a few of the benefits RPA offers.

In the [8] case study, we reviewed the process model regarding how software testing automation allows us to accomplish the testing process in a faster way than compared to the traditional software testing process. This study differentiates Selenium web Driver and Work Fusion, which are the two methodologies of the software test automation with the new RPA based method. This study recommends combining the test scripts written in different programming languages with the RPA solution for performance improvement, less usage of resources, and making the tests more efficient, reliable, and accurate.

RPA has proven itself to be capable of performing and completing high volume processes which consist of redundant as well as tedious steps. In the research [9], RPA is used to automate the repetitive task of filling out and reading Google forms and input the information filled out in the form, onto a spreadsheet, for educational workshops. Since the software bots follow the exact steps and instructions given

to them initially, RPA can effectively perform redundant tasks repetitively without leaving any room for human error.

3 Objectives

1. Maintaining adequate stock of medications-

Ensuring there is adequate stock of medications available in the inventory is one of the prime motivations behind the need for efficient management of inventory. The quantity of any given medicine in the inventory should neither be too much that it expires before being sold and nor too little that it's unavailable when needed.

2. Minimizing the occurrence of unavailability of medications-

The occurrence of situations where the stock of the required medication isn't available or the medicines in stock are expired should be minimized to decrease the impact on patient care.

3. Reduction of cost of maintaining an inventory-

The goal of the system is to decrease the carrying costs of maintaining and updating the inventory while keeping the process smooth and efficient so that it benefits the healthcare organization as well as helps cater to the customers better.

4. Limiting the use of resources for purchasing tasks

An efficient inventory management system should ensure that minimal resources such as time and human efforts are spent on ordering medications. These resources can be saved or put to better use elsewhere in the system.

5. To contribute to the overall profitability of the healthcare organization

The goal is to decrease the total costs to the pharmacy and health care organization by focusing on purchasing products with the lowest price, thus resulting in a profit to the organization. This can be achieved by selecting a vendor that helps keep the acquisition costs as low as reasonably possible.

4 Existing System Architecture

The existing supply chain management framework has mostly relied on the personnel or a group of people handling the system. Also, none of them have a clear idea for the entire product journey as the process flow and teams are isolated. The processes of vendor selection and management of inventory are handled manually. Here, personnel responsible for Vendor Selection reads all the quotations received from the various vendors and compares them based on single or multiple criteria. The vendor with the best offer is selected, and the personnel updates it on the dashboard.

Another personnel responsible for Inventory Management carries out the tasks of checking the inventory and keeping track of the quantities of the items in stock to determine what medicines or products to order. When the quantity

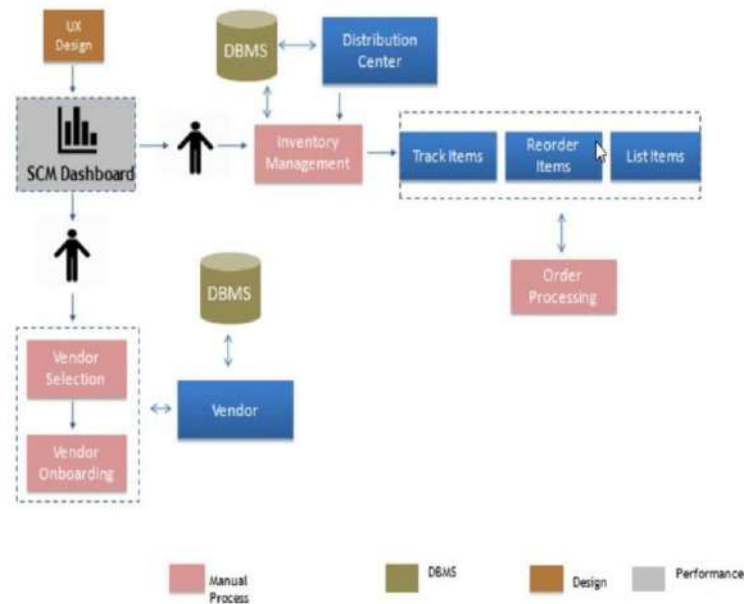


Fig.1. Existing System Architecture.

of a product falls below a specified threshold, the personnel manually add it to the list of products to be restocked. Upon receiving the order from the vendor, this personnel again updates the quantity of the item in the database.

One of the drawbacks of such a system is that it's more vulnerable to human errors. The team members need to make multiple phone calls or scan through the long email threads to get the desired information which results in ongoing inefficiencies. A minor mistake or negligence by the person handling the system could affect both- the enterprise and its patients/customers. Also not all the incorrectness are being captured and fixed in a timely manner. Another drawback of the current system is that it's time-consuming. Certain processes, such as checking inventory, reading and comparing vendor quotations, and finalizing a supply vendor require more attention to details. Thus, the execution of such tasks takes more time when carried out by a human. Instead of spending hours doing repetitive tasks it can be automated for greater accuracy and ability.

Fig 1. is about the Existing System Architecture of the Supply Chain Management.

5 Proposed System Architecture

We propose a novel system where software bots will be programmed to carry out processes such as vendor selection, vendor onboarding, inventory management, and order processing which were previously carried out manually. In other words, the repetitive and time-consuming processes of the Supply Chain Management will be automated with the help of Robotic Process Automation (RPA). The incorporation of this automation within the system will make it less prone to errors as well as less time-consuming. Thus, this new proposed system will lead to increased productivity and throughput.

With the help of RPA platform, we create a centralized location to connect all systems which can help the team members to access the required information. So team members can easily get real-time data and overcomes the disadvantage of the existing system of searching for a particular data from the record book.

The vendor selection and onboarding processes will take place when the tenure current supplier terminates. The vendor selection procedure compares the quotations given by several candidate vendors and selects the deal with the best terms. The onboarding process will finalize the vendor selected, and make changes in the system and database accordingly.

The inventory management and order processing procedures of the system are executed on a daily basis. The inventory management automation keeps a track of the pharmacy's inventory. When the available quantity of any medical product goes below its threshold value, the system will send an email to the supplier regarding the restocking of supplies.

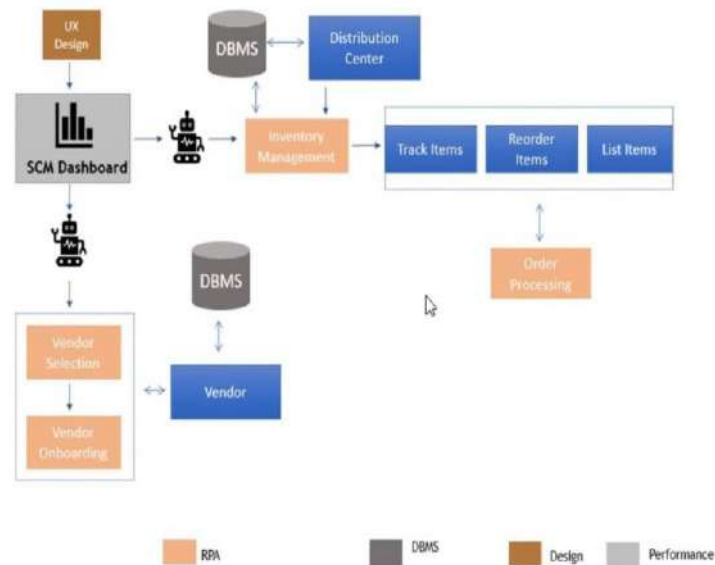


Fig.2. Proposed System Architecture.

Upon receiving an 'Order Confirmed' or 'Order Delivered' email from the supplier, the order processing automation will make the necessary changes in the inventory database. The automation minimizes the time, effort, waste and labor cost and maximizes the productivity and financial improvements.

Conclusion

The existing supply chain framework has a lot of shortcomings and we believe these are mainly because of the human management of processes. So, we have proposed a novel supply chain management framework in the healthcare sector, using Robotic Process Automation. By programming BOTs to automate certain processes in a system which were previously handled manually, we can overcome the several shortcomings in the supply chain management system, such as frequent human errors, excess delay, inaccuracies, etc. Automating the key processes, such as Vendor Selection, Vendor Onboarding, Inventory Management and Order Processing with the help of RPA Tool, can help us make the system more reliable and easier to implement.

Acknowledgment

The success of this proposed system would not have been possible without the constant encouragement and advice from a vast number of people. We, the authors of the paper “Automation of Supply Chain Management for Healthcare,” would like to express our sincerest regards to Mr. Kiran Deshpande, for their valuable inputs, guidance, encouragement, and constructive criticism throughout our paper. Furthermore, we would like to thank the entire staff of the Computer and Information Technology Department for lending us a helping hand when we most needed it.

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