

Data Acquisition, Monitoring and Management of Purchased Items Using Java Programming

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Abstract—The Purchasing department manages all related transaction of items and services of the institution. In Lyceum of the Philippines University – Laguna (LPU-L), the Purchasing department provides services to item purchases of the school (inside or outside the campus). The method of monitoring and storage of data is done manually. Considering that purchasing transaction is becoming plentiful in just a month’s notice because of different colleges requiring items to be bought, the task of in-charge personnel is becoming laborious and tedious. With increasing purchase of items and rendering of related services, it is essential that information will be kept organized and secured. This paper proposes a system for effective data monitoring and management of transactions related to purchasing of items in Netbeans IDE platform using Java programming language with additional use of Apache POI Application Program Interface (API) to control and manipulate Excel files. Item specifications and transactions are to be stored in a Spreadsheet, as it offers easy manipulation of cells, sheets and workbooks. Ergo, it is easy to manage formulas for arithmetic use and it provides visual presentation of data through graphs and charts. The developed system is capable of handling data entered by the user and it will easily store the data in its proper excel directories, which would simplify and speed up the manual method of managing data. The system is also equipped with searching methodology and printing of summary report. This would facilitate tangible monitoring of data and its status. Most importantly, the system could further assist the decision making of the department head.

Index Terms—Purchasing Department; Netbeans IDE; Java; Apache POI; Microsoft Excel; Software Engineering; Data Monitoring.

I. INTRODUCTION

The purchasing department of an institution provides services that serve as backbone of manufacturing, retail, military and other industrial organizations [1]. The department is responsible for procuring of materials and in order-placing. Before, the task is primarily a clerical work, but as time goes by, it had evolved to a more systematic and advanced business role, adapting multiple functions that handles purchases. At present, purchasing is commonly referred to as supply chain management [2]. The roles of a purchasing department are the following: (1) Supply Sourcing, (2) Bidding, (3) Supplier Management, (4) Cost Control, and (5) Legal Controls [2]. All of which should function accordingly in order to provide the maximum efficient service to the institution.

In this modern day of innovations, technology has become a vital part of most businesses as well as organizations and institutions. Systems are being developed in order to aid human labor and make the job easier, faster and better. Not just that, it also increases productivity and work force, which

in turn produces good output with minimal error and more accurate specifications [3].

Technological intervention is truly a great marvel in this modern age and developing a system for Purchasing department of LPU-L to cater transactions related to purchasing of items is vital. The proponent had conducted an interview with the department head so as to know what functionalities the department head needs in order to make her job easier. It was found out that the department makes use of Microsoft Excel in storing and managing the data of each transaction of purchased items for different colleges and departments of the institution. Moreover, she makes use of check sheet for manual log-in of transactions. Each data is manually encoded in Excel file and she manually transfer the encoded data from one excel sheet/workbook to the other. This task is indeed a tiring work and susceptible to human errors. With that in mind, the proponent decided to provide a system that will facilitate systematized acquisition, monitoring and management of data.

In this project, the proponent will determine: (1) How can the old method of manually gathering and storing of data of Purchasing department be improved by introducing a new software? (2) What specifications should the system consider and obtain in order to meet necessary improvement? (3) What makes Java programming language preferable in developing the system? (4) What will be the benefit of utilizing the proposed system in the campus? These are itemized problems that the proponent would like to address in this project.

The focal objective of the project is to develop a system for Purchasing Department of LPU-L to effectively monitor and manage its purchased items. Specific objectives of the project are:

- To create a user-friendly GUI in Netbeans IDE using Java programming language,
- To systematically acquire, verify and record legitimate purchased items in Microsoft Excel,
- To create a system functionality that will quicken the process of data insertion and transferring of data from one Excel file to the other, and
- To minimize data error by automating the manual method of monitoring and management of purchased items.

In this work, the proponent organizes the paper in five important sections: Section I discusses the introduction, Section II focuses on the literature review, Section III on the methodology, Section IV emphasizes the results and discussion and finally Section V is disclosing the paper’s conclusion and future directives.

II. LITERATURE REVIEW

This section contains brief reviews of researches and systems related to the proposed. Knowing other project's specifications and results would help the proponent identify the need and roadmap of the system. Reviews will also help proving that the system can provide improvement on the existing ones in various terms.

Online shopping system is one of the best processes that costumers can use if they desire to purchase an item on the basis of what they want and what they need. Through this system, the consumer is able to save time in their purchases. In this paper, the proponents introduced the concept of programmed purchasing system (PPS). The PPS will record all transactions pertaining to purchase of items at any time, even you are offline or online. PPS provides long-term records that will be saved directly in Microsoft Excel using VBA macro program. The program allows quick response of both consumer and supplier [4]. According to [5], it is necessary to create certainty depending on the behavior of the consumers. The purchasing decision-making based on models of long-term and short-term marketing actions is advantageous as it would facilitate increase on the value chain, combining it into a hybrid market scheme [5]. More so, a system based on contextual information of click and purchase data to items for e-commerce was studied in 2016. It was stated that graphical user interface (GUI) is vital in assisting the client and merchant. Their work puts an algorithm in making their system more accurate and intelligent. The framework was tested and was analyzed, so that functionality of the system can further be improved [6].

In the previous work of the researcher, entitled "Design, Development and Implementation of Purchasing Management", the proponent makes use of Excel VBA macro program in assisting the purchasing department of the institution. The created program had helped the client and admin in the requisition and approval of items. It was able to provide them a tangible monitoring and recording system of essential data and information. The system was tested for requisition and approval of items as evidenced in different screen shots [7].

A. Synthesis of Literature

System integration to businesses is indeed a great upgrade to the work and labor of the company. As latter discussed, the system provides ease of access to data and current processes by which the system works. Quick responses are also evident, considering that it is becoming just a matter of clicks. Security is also a plus. GUIs and database systems would help the company handle its transactions and processes smoothly. System integration will also provide the customers a user-friendly interface with effective system functionalities for their transactions and affairs in the company. With that, it is believed that system integration is of great assistance to admins and users alike. Thus, providing a data acquisition, data monitoring and data management systems in a single program for Purchasing department is feasible and would address laborious work of personnel in-charge.

B. Conceptual Framework

In representing the framework of the study, the proponent illustrated the main processes of the system using block diagram as shown in Figure 1. The first main process is the data acquisition in which the Purchasing department receives

the signed purchase order from other department. The request will be encoded using the GUI for Purchased Items. The encoded data will be stored in an Excel file and it will be formatted properly for ease of data search and print. The main blocks of the system were patterned from the reviewed literature and it was aligned with the need of the Purchasing department.

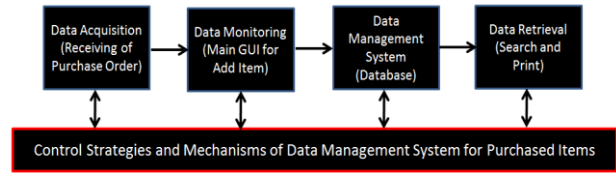


Figure 1: Block diagram of the system

III. METHODOLOGY

Figure 2 on the next page depicts the modified waterfall model for data acquisition, monitoring and management of Purchased Items. Waterfall model is a software developmental model in which the activities are being represented by blocks and are followed in sequence. The waterfall model is a sequential design process, often used in software development processes, in which progress is seen as flowing steadily downwards (like a waterfall) through the phases of Conception, Initiation, Analysis, Design, Construction, Testing, Production/Implementation, and Maintenance [8]. In this work, the proponent modified the traditional waterfall by itemizing process that fits the study and removing maintenance.

The modified waterfall model used in this study is consisted of nine blocks. As shown in the figure, the first block is the Topic Conceptualization, Brainstorming and Consultation. In this block, the proponent formulated an idea and solicits suggestion from the client and asked approval from his adviser. Next phase is the Problem Identification, Scopes Definition and Setting of Objectives. In this step, the proponent was able to observe problem in manual monitoring of room temperature. The third important step is the Review of Related Literature and Synthesis. In this task, the proponent made a comprehensive research on related literatures, reviews them and summarized them. The proponent was able to identify different methods in solving the problem and was able to see the gap between existing and past studies with that of proposed. The fourth one is the Research Methodologies. In this step, the proponent was able to conceptualize the framework of the study as well as the methods that he will be using in designing and developing the system. The fifth stage is the design and development of data acquisition, monitoring and management system of Purchased Items. This main block is further specified into four sub-sections namely: Data Acquisition, Data Monitoring, Data Storage and Data Retrieval which were discussed earlier in Figure 1. These four sub-blocks are essential in providing tangible, reliable and effective system for the Purchasing department. The System Testing comes next, in which the proponent will need to test the system to see if there's a problem and if the system is producing accurate and/or reliable output. Afterwards, the system will be finalized and it will be made available to its end-user. Finally, the complete system will be deployed and implemented.

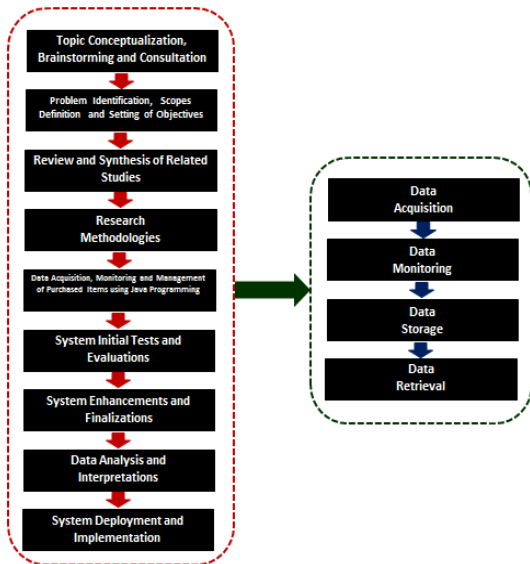


Figure 2: Modified waterfall model for purchased items system

A. Proposed System

The proponent shall be using Java programming language in Netbeans IDE to create a system that is able to manipulate Excel file in order to facilitate functionalities such as add, search and print. The system shall also use a database for the signing-in account of the administrator. This is to ensure security considering that the file contains vital and classified information that is only intended for specified personnel. The system will aid in the data management of the Purchasing department and would consequentially hasten the activities done compared to the old approach of manually encoding and retrieving the data.

B. System Flowchart

Figure 3 shows the flowchart of the system. As shown in the figure, the admin shall be driven to the log-in screen where he/she shall enter his/her password, successful logs makes the main program available. The user shall either pick the necessary Excel file or create a new one. Either way, after doing such, the user is prompted to the following: enter an item specification to the Excel file, search an item or create a report on the expenses of the Purchasing department.

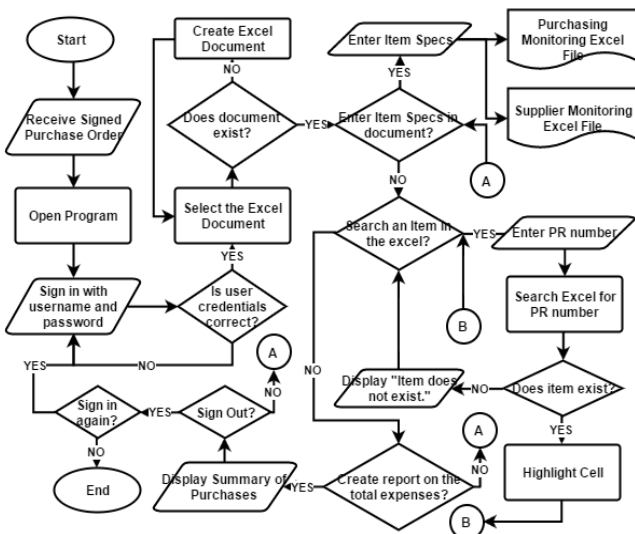


Figure 3: Flowchart of the system

C. Data Flow Diagram

To further understand the flow of data, the proponent elicits the data flow diagram (DFD) of the system in Figure 4. The DFD shows the flow of data within the system from start to finish with greater emphasis on the thread of entities [9].

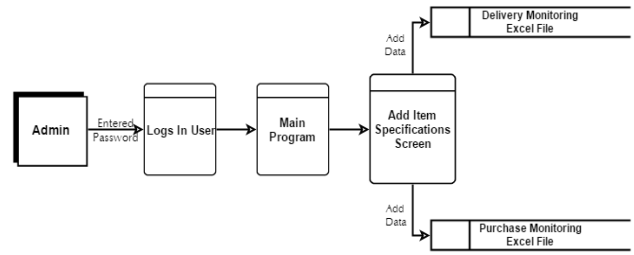


Figure 4: Data flow diagram of the system

D. Work Breakdown Structure

Work Breakdown Structure (WBS) is a deliverable-oriented, hierarchical decomposition of the work required to achieve a project's objectives and produce the required project products. The *indented-outline format* in Figure 5 for the system allows you to read and understand a complex WBS with many components [9].

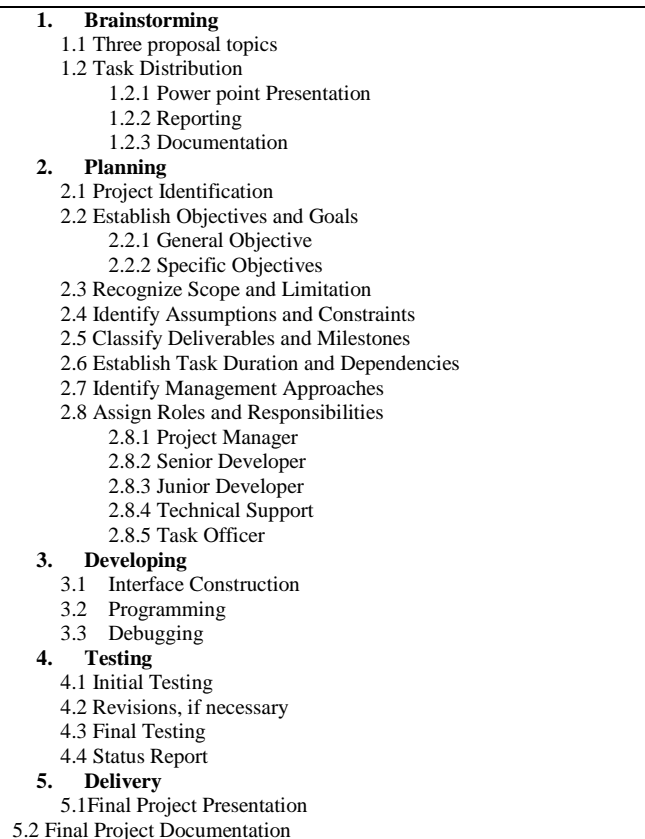


Figure 5: WBS of Purchased Items system in indented outline format

E. Network Diagrams

A network diagram is a flowchart that illustrates the order in which the project activities are being performed. It is the project's test laboratory, as it gives the project manager a chance to try out different strategies before performing the work. The network diagram has the following three elements: milestones, activities, and durations. A *milestone*, sometimes called an *event*, is a significant occurrence in the life of a project. An *activity* is a component of work performed during

the course of a project. Activities take time and consume resources; you describe them using action verbs. *Duration* is the total number of work periods it takes to complete an activity [9].

In this work, the proponent represents the 15 main activities of the project with its immediate predecessors in Table 1. The network diagrams of the table from start to finish is further illustrated in Figures 6, 7 and 8 respectively. The activities are represented in rectangles while highlighted blocks represent the milestones of the project with respect to its time duration.

Table 1
Activities for Purchased Items System Project

Code	Activity	Immediate Predecessors
1	Brainstorming	None
2	Project Conceptualization	1
3	Project Proposal Presentation	2
4	Creation of Project Plan	3
5	Final Revision of Project Plan	4
6	Interface Design and Software Development	5
7	Database System	5
8	Project Evaluation	5
9	Initial Testing and Error Detection	6, 7
10	Software Evaluation	6, 7
11	Debugging	9, 10
12	Final System Revision	9, 10
13	Final Testing	11, 12
14	Finalization of Project	13
15	Project Completion	14

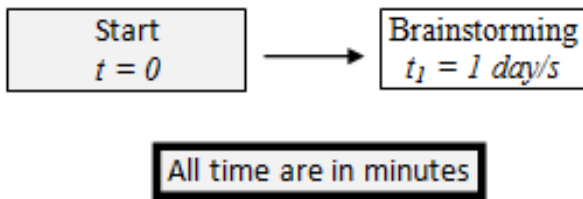


Figure 6: Starting purchased items system network diagram

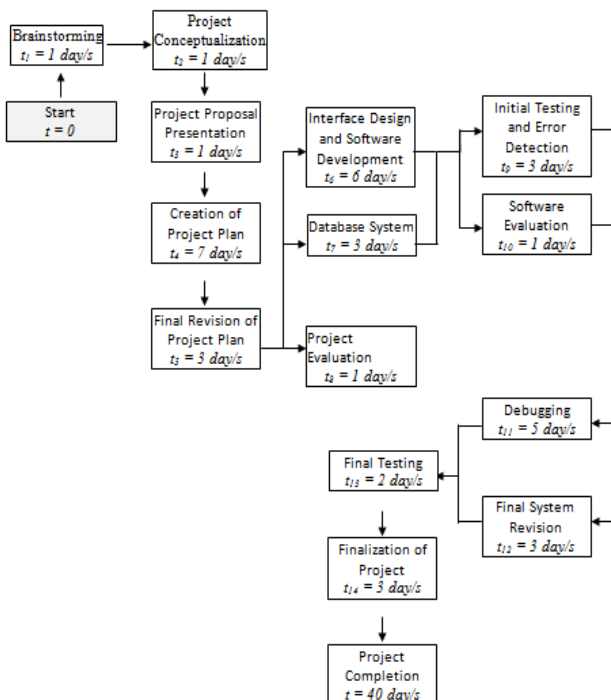


Figure 7: Continuing purchased items system network diagram

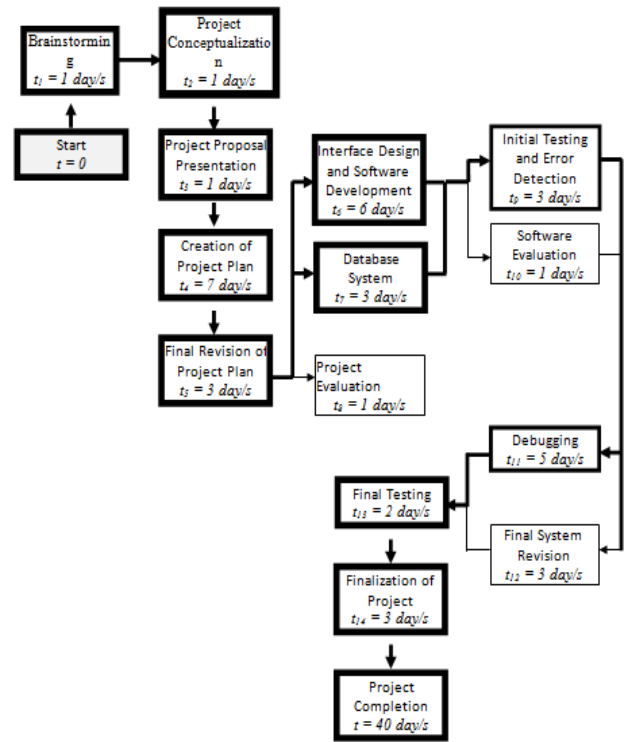


Figure 8: Completed purchased items system network diagram

F. Task Duration and Dependencies

Combined milestone and Gantt chart is a timeline that illustrates when activities start, how long they continue, when they end, and when selected milestones are achieved. On the other hand, *Task duration and dependencies* is a table listing the milestone and activity dates with its corresponding duration and dependencies as shown in Table 2 [9].

Table 2
Task Duration and Dependencies for Purchased Items System Project

Activity	Duration (days)	Dependencies
Project Conceptualization	7	
Construction of Project Proposal	7	T1 (M1)
Creation of Project Plan	12	
Objectives and Goals Identification	3	
Scope Recognition	3	
Assumptions and Risks Identification	2	T1, T2 (M2)
Project Management Approach	2	
Integration of all parts of the Project Plan	2	
Final Revision of Project Plan	7	T3 (M3)
Development of the Project Software	20	
Interface Design	8	
Programming Application / Coding	12	
Finalization of the Project	7	T4, T5 (M4)

G. Java Programming Language

Java is one of the most famous programming languages that are being used as of 2017. Java is considered to be a high-level programming language, as it has high level of abstraction compared to low or mid-level programming languages such as Assembly, C and C++. Furthermore, High level languages are more portable, meaning they can run on any computer independent of the hardware or even OS of the system as long as the required resources are present. Java uses the same concept and is called "Write Once, Run Anywhere" (WORA), where compiled Java code can be run on any platforms as long as it provides Java essential materials without requiring re-compilation [10].

H. Application Program Interface or API

An Application Program Interface (API) is mostly used in GUI components' programming. APIs are used to communicate system software to another by having interactions. APIs are often provided by software developers in order for its end-users to make use of the given software. An example is the Google Maps API, in which the API lets developers embed Google Maps on their program, webpages, and other software systems as long as it has JavaScript or Flash Interface [11, 12].

I. Apache POI – the Java API for Microsoft Documents

The Apache POI is a project which aims to maintain Java APIs capable of operating Office Open XML standards (OOXML) and Microsoft's OLE 2 Compound Document format (OLE2). In other words, Java developers will have the power to operate Microsoft Office files such as Word, Powerpoint, and Excel [13].

J. Netbeans IDE

Netbeans is an open source Integrated Development Environment (IDE) which offers multiple set of tools for the development of different programming languages such as C, C++ and Java. It also offers ease in developing Java applications either mobile or desktop as well as web-based languages such as HTML5, CSS, PHP and Javascript. Moreover, the IDE is commonly known for its compatibility with the latest Java version 8 language. The IDE offers editors, converters and code analyzers, so as to easily upgrade applications to use the new Java 8 [14].

IV. RESULTS AND DISCUSSION

This chapter contains the system's GUI and functionalities as well as the results and outputs it yields.

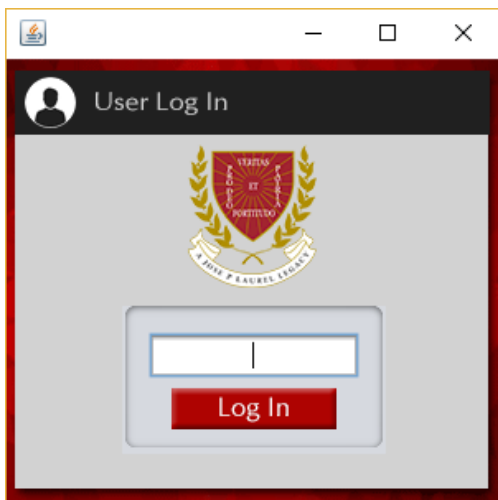


Figure 9: Admin log-in screen

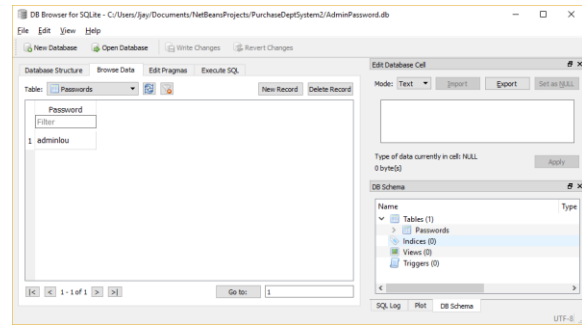


Figure 10: Database for admin password

The first screen that prompts when the system starts is the log-in form as shown in Figure 9. The system is designed specifically for the admin, thus there is no need to sign-up an account. However, the system makes use of SQLite database, as depicted in Figure 10 to store the admin's password to give him/her the capability of changing it whenever needed.

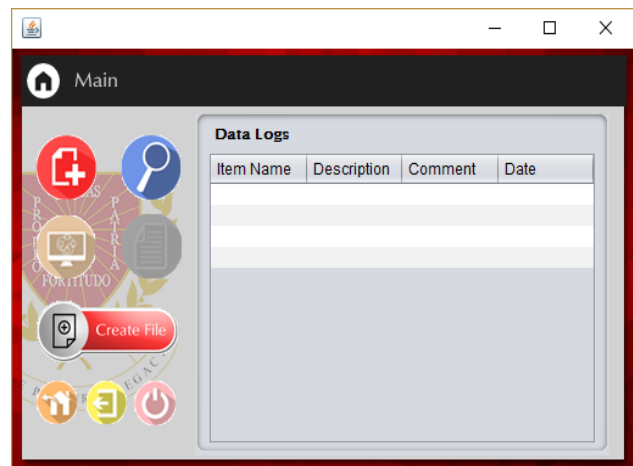


Figure 11: Main Program

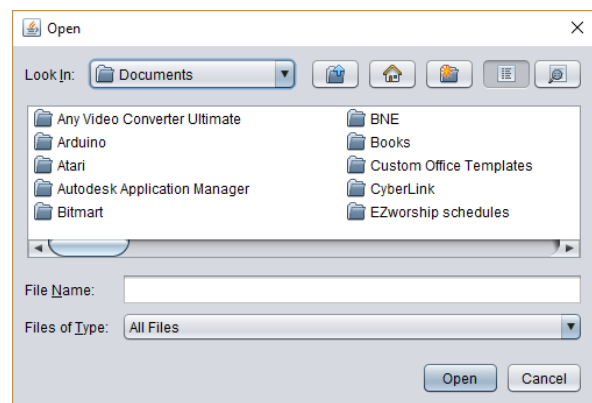


Figure 12: jFileChooser function

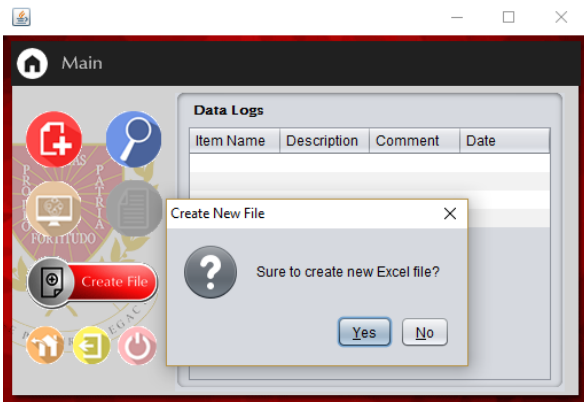


Figure 13: Prompt message to create new Excel file

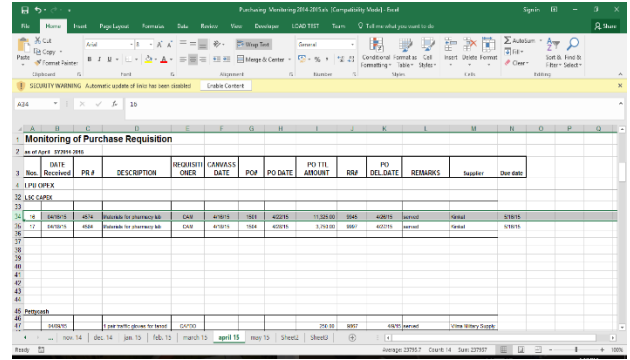


Figure 17: Purchasing monitoring Excel file

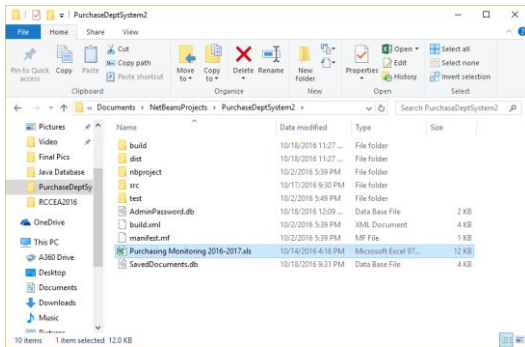


Figure 14: Newly created Excel file

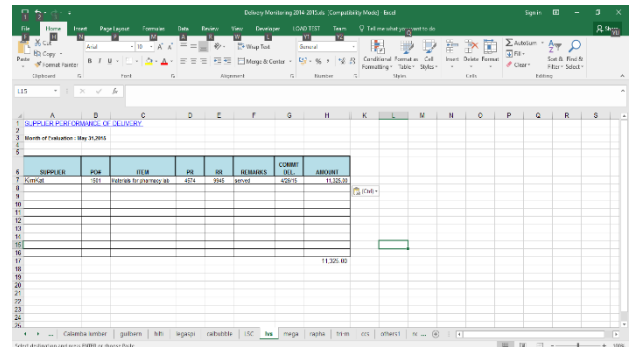


Figure 18: Supplier monitoring Excel file

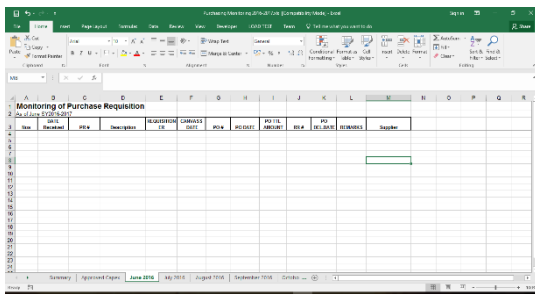


Figure 15: Newly created Excel file contents

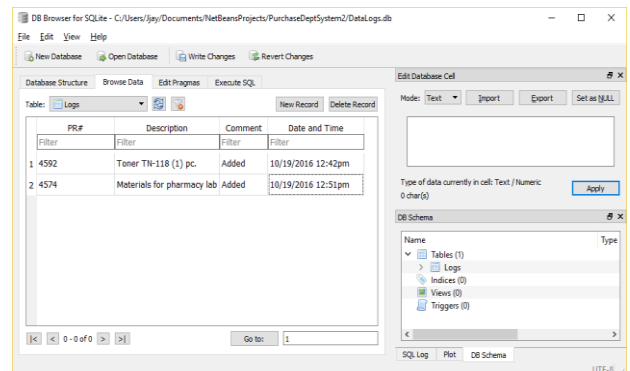


Figure 19: Database for storing data logs

Figure 11 shows the “Choose File screen” that will pop out after successful logged in. In here, the user can either choose an existing excel file by the use of the jFileChooser method (shown in Figure 12), which opens a dialog box where the user can navigate through the disk’s files and specify the Excel file that is needed to be worked on, or create a new one along with the template of the Purchasing department’s item managing file as shown in Figures 14 and 15.

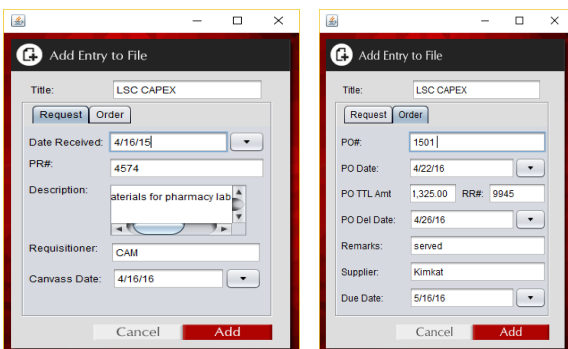


Figure 16: Add entry to file

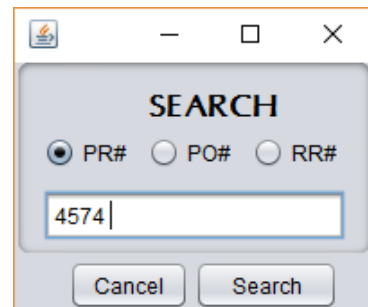


Figure 20: Search window

Figure 16 shows the main screen of the system that allows the admin to manage data entries in the Excel file. The window houses a table for recent activities and 7 functional buttons namely: Add Entry (Top left), Search (Top Right), Supplier Monitoring (Middle Left), Summary Report (Middle Right), Exit Main (Lower Left), User Log Out (Lower Middle) and Close Program (Lower Right). The Supplier monitoring button opens the Excel file for the supplier monitoring. The Summary report opens the Excel file for purchase monitoring

and shows the summary report sheet wherein the total breakdown of expenses of all the Colleges and faculty are shown. The Exit main Button closes the main program and goes back to the file choosing window. The User log-out button signs off the user admin and be prompted back to the log-in window. The Close program button closes the whole program.

More so, Figure 16 depicts two tabbed panes that contain several text boxes to be inputted by the user. When finished filling up the required fields, the entry shall then be added to the Excel file for purchasing monitoring (see Figure 17) and supplier monitoring (see Figure 18). A database stores the purchase request number (PRN), item description, comment, and the date and time when the user added the data. It is then shown on the table for data logs.

Figure 20 shows the search window in which the user will type a number depending on his/her preference. It could be a Purchase Request number, Purchase Order number or Received Record Number as shown in radio buttons. Once search is pressed, the system searches the Excel file corresponding to the indicated textbox value.

V. CONCLUSION AND FUTURE DIRECTIVES

In conclusion, the proponent was able to achieve the objectives of the project. The proponent made a user-friendly GUI in Netbeans IDE with the use of the Java language and assistance of Adobe Photoshop for the designs. The system was made capable of transferring data to the Excel file easily and systematically with just click of a button, thus increasing work productivity and quickening the process. The manual method of monitoring and management of purchased items was made automatic with effective fool proofing validation techniques thus minimizing human errors for data encodes and transfers. With the project in its initial stage, it is highly suggested that series of tests should be done with the Purchasing department head, so as to know the flaws of the system and make further improvements before it could be pilot tested and implemented. Also, tests should also be conducted on the basis of accuracy and speed, so as to measure statistically the improvement from previous old method. Ergo, future developers can further enhance the system by adding more functionality such as providing graphs on total purchases of one College or department and show visually their expenses. In the technical side, other programming language and other modelling tool could also be tried and applied.

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