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THE PIECES FRAMEWORK AND MEASUREMENTS: PERSPECTIVE OF ANALYZING MANUAL OPERATIONS TOWARDS DEVELOPMENT OF SOFTWARE APPLICATIONS

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Abstract: This study explores the dynamic transition from manual operations to the development of software applications through the lens of the PIECES Framework and the strategic use of measurements. In an era where automation and digitization are reshaping industries, understanding the intricate interplay between manual processes and software development is of paramount importance. The PIECES Framework serves as a structured approach to dissect and analyze this transition, while measurements provide valuable insights into the process's efficacy and optimization. This abstract offers a preview of our comprehensive exploration, revealing the significance of this perspective in enhancing the efficiency and effectiveness of software application development. Through empirical evidence and practical insights, we illuminate the path towards more seamless and successful integration of manual operations into the digital world. This study delves into the integration of manual operations into the realm of software applications, seeking to provide a comprehensive perspective on the process. We explore the PIECES Framework as a conceptual guide and emphasize the role of measurements as essential tools for analysis. Our research aims to bridge the gap between human-driven processes and software development by shedding light on the intricate relationship between the two. By examining this dynamic interplay, we uncover insights that can enhance the efficiency and effectiveness of the software development process. The convergence of manual operations and software applications is a pivotal aspect of modern software development. To navigate this complex landscape effectively, understanding the interplay between these two realms is crucial. In this study, we explore the PIECES Framework and the role of measurements in providing a comprehensive perspective on the transition from manual operations to the development of software applications. This paper delves into the intricacies of this transformation, emphasizing the significance of structured analysis and measurement in optimizing the development process.

Keywords: Scholarship Grant, Pieces Framework, Online Application, RAD, Online Application, Web-Based Application.

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1. INTRODUCTION

The development of technology has been emerging rapidly to create the most efficient tools to speed up the transactions of organizations or businesses. According to Yoshiaki Ono and Setsuya Kurahashi (2015) people are now able to access the Internet from anywhere since wireless LAN hotspots are widely spread. Hence, people require device-independent applications that can access the same information from various places, such as their homes, workplaces, and schools. One such application is a web-based application. The number of users of web-based applications has increased greatly according to their popularity. Because of the scalability of internet access around the world (Wu, 2017) with the development of web and security technology, the challenges are how to achieve real-time transaction processing, scalability, security, and client authentication. As cited by Thalia Anagnos (2018), the goals of the scholarship program are to increase the number of low-income academically talented students completing STEM degrees while simultaneously generating knowledge about curricular and co-curricular activities that support student success and increase graduation rates. In line with the objectives of scholars, they have provided a multitude of scholars every semester, and every year it produces happiness for the graduate students supported by this scholarship.

Kissell (2013) stated that storing records and documents requires a large amount of literal space and spawns inefficiencies in searching for previously filed paper documents. Along with the current procedures of the office, employees use paper-based tools to gather scholarship applications from students, which might be easily damaged. There is no easy saving of records that can be opened for reporting and basic purposes. Using a paper-based process is a challenging effort at times; employees cannot simply disseminate documents and reports compared to the digital side

(Welsh, 2007). With a complex record of scholars, some areas need improvement to address the problems. Currently, the procedures for applying for a scholarship and managing and evaluating application forms are done manually using paper-based processing. The cost of printing forms, photocopying requirements, and transportation expenses has been a problem financially for the students and the stakeholders. Experiencing queues when submitting applications due to the presence of different variants of COVID-19 viruses that we need to pay attention to. Their current online Google Form application is allowing multiple entries with the same student results on conflicting records, their inefficient backend is using Google Sheets as their database for multiple records, and calculations are done manually. According to (J. Onaolapo, M. Lazarov, and G. Stringhini (2019) Google Sheets is a cloud-based data processing tool that allows users to manage records, perform computations, transform cells, and share files for collaborative purposes.

According to A. Fasolino, D. Amalfitano, and P. Tramontana (2013), they are indeed distributed systems with a client-server and/or multi-tier architecture; they can be concurrently accessed by a wide number of users from all over the world with heterogeneous execution platforms composed of different hardware, network connections, operating systems, web servers, and web browsers. However (D. Johansson and M. Holmgren, 2014), web apps are developed using web technologies, preferably HTML5 and related frameworks. A web app can be run on any device equipped with a web browser and a network connection, and web apps allow cross-platform functionality. Web-based applications allow users to interact with a remote server through a web browser, and it has been proven in recent years that an increasing number of web-based applications are replacing desktop applications. Some characteristics of this application are the accessibility of different platforms, which can be accessed anytime and anywhere through the internet. (Orioque J., Cabardo J., Selpa H., 2021) in the development of a web-based scoring system for beauty pageant events in the school using a Rapid Application Development (RAD) model of their system development process. The system allowed any number of judges to enter their scores for varying rounds throughout the pageant. After each category, the system generates results in PDF form ready for viewing and printing, which judges can sign, indicating the reliability of the result. In this way, pageant results were ensured to be accurate per signed hard copy evidence.

This study aimed to propose an online scholarship-granting program using rapid application development. According to Ginanjar Wiro Sasmito, Dega Surono Wibowo, and Dairoh (2020) RAD is a set of methods that have been developed to overcome the weaknesses of traditional system development methods such as the waterfall model and its variants. This method is applied in the quick application development cycle and provides good-quality software compared to those provided using traditional software engineering approaches. Through a rapid software development process, the organization can cost-efficiently develop and maintain software. The proposed system will provide a student portal explicitly illustrating their qualifications and eligibility for the scholarships they apply for. It will accept attachments of files for requirements, and it can prevent redundant submission of applications to avoid conflicting records. This study uses two (2) methods, namely rapid application development and the PIECES framework. Rapid Application Development, also known as RAD, In addition, the proposed system aims to integrate an SMS feature to disseminate information about all scholars and notify them of the status of their applications. If an enterprise wants to build an application consisting of SMS and business management, a web-based SMS application is a good choice, according to Chao Geng (2012).

2. PARADIGM OF THE STUDY

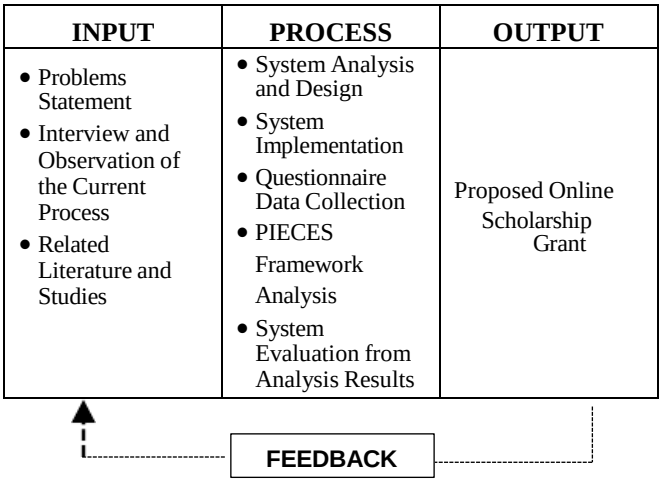

Figure1. Conceptual Framework for the User's Satisfaction Analysis in Scholarship Grant

This framework consists of the stages of research conducted by the researcher, starting with data collection, identification of needs, system analysis and design, system implementation, data collection of the questionnaire, analysis of the results of the questionnaire, and finally the evaluation of the system based on the results of the analysis.

3. OBJECTIVES OF THE STUDY

This study aimed to evaluate the existing system for scholarship grants in Bro-Ed that led to online scholarship grants. The specific objectives of this study are the following:

(1) To determine the students' satisfaction level of the scholars in using the traditional system in terms of the PIECES framework.

(2) To determine the students' satisfaction level of the scholars in the proposed system in terms of the PIECES framework.

(3) To determine the significant differences in students' satisfaction level of scholars between the manual system and the proposed system in terms of the PIECES framework.

(4) To determine the significant differences in users' satisfaction levels between scholars and Schools in the proposed system.

4. METHODOLOGY

In this proposed system, the researcher uses three (3) methods, starting with system development using the Rapid Application Development (RAD) method and the PIECES method, to analyze the results of evaluating the level of user satisfaction with applications that have been made.

4.1 DATA COLLECTION STAGE

According to Onishi H., Asaka T., and Mogi R. (2017), research on data collection methods, research to collect data efficiently at the time of disaster [10], and data collection under circumstances

where it cannot connect to the Internet are being studied. At this stage, data collection was carried out directly by asking scholars, students, and staff to use their existing system.

4.2 REQUIREMENT SPECIFICATION

At this stage, it is also called requirement specification, which is to identify the system objectives to be designed and the information needs and requirements for developing the proposed system. According to M. Osman and M. Zaharin (2018) states that software requirement specification (SRS) is the foundation of software development, and all subsequent steps in software development are influenced by this document. Hence, a high-quality SRS may increase the possibility of high software quality.

4.3SYSTEM ANALYSIS AND DESIGN

sAccording to Kumari R. (2021), System Analysis and Design is a problem-solving strategy that includes glimpsing at the more extensive system, breaking the separated parts, and sorting out how it works to accomplish a specific objective. At the SAD stage, authors make models for a new application that can represent a system that is already running on the Online Scholarship Grant. It involves investigating or improving the process to fulfill necessities for end users.

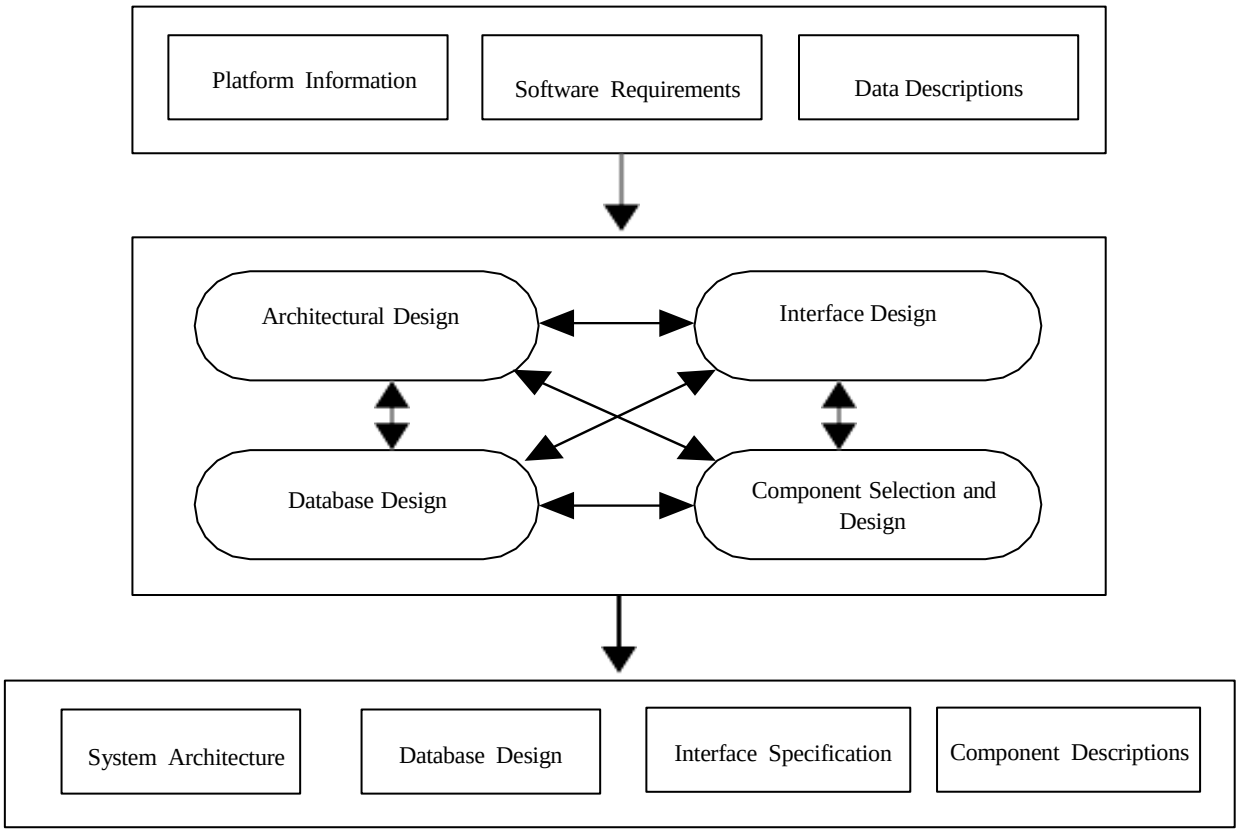

Figure 2. General Model of Design Process

4.3.1 **Architectural Design.**

According to A. Jansen and J. Bosch, an architectural design decision is therefore the outcome of a design process during the initial construction or the evolution of a software system. Architectural design decisions, among others, may be concerned with the application domain of the system, the architectural styles and patterns used in the system, COTS components and other infrastructure selections as well as other aspects needed to satisfy the system requirements This stage, the authors identified the overall structure of the system, subsystem or modules, their relationship, and how they are distributed. It involves developing database design through developing Entity Relationship Diagram (ERD), Designing Interface and component design of scholar's portal, and backend system using HTML, CSS, JavaScript, Bootstrap Framework, and PHP Programming.

4.3.2**Database Design.**

According to Juxiang R. and Zhihong N. (2012): Database design is the foundation of application system design. In the process of database design, the first is accurately expressing user demands with proper tools, such as a data flow diagram, data dictionary, etc. It is eliminating data redundancy, rewriting, deleting, and inserting anomalies under the guidance of normal form theory. With the information that the authors gathered during requirements specification and with the help of the existing system, they designed the database structure of the proposed system. Using the Entity Relationship Diagram (ERD), the authors critically analyzed and understood the flow of data and the relationship of each attribute of the given database to derive the database architecture design.

4.3.3 **Interface Design.**

According to Sharma V and Tiwari A. (2021) User interface (UI) is the asset that helps the user to interact with the product's interface for services. For example, User Interface consists of visual design elements including colors and typography. The user interface is also used to look at the functionality of the screens or the unconventional systems like the processes that are voice- based**.** The authors came up to design the interface of the proposed system with the modern User Interface. Using Adobe XD tools initialized the interface design and integrated it into a web-based platform using HTML, CSS, JavaScript, Bootstrap Framework, JQuery, and PHP Programming.

4.3.4 **Component Selection and Design.**

According to Cao J., Ren L., Weisong Shi, and Yu Z. (2014) Before designing a combination of components for an application, it is extremely significant for the practitioners to define the requirements of performance very clearly. The system components have a significant impact on the system's performance. The number of combinations could be considerably large, and practitioners could feel no place to start when facing such a large dataset**.** The authors integrated an SMS feature to update the status of applications from scholars, reliable hosting, and domain providers that can improve the performance of the proposed system.

4.4 SYSTEM IMPLEMENTATION STAGE

According to Ivanova et al. (2014), many types of management systems exist to manage an organization's workflow, financial assets, and information. However, implementing such management systems typically follows similar programmatic steps, where existing practices are phased out and new prescribed practices are implemented. Implementation is a phase to introduce the system that has been created by the authors for users to see and study in more detail. After that, special testing will be given to implement the system.

4.5 QUESTIONNAIRE DATA COLLECTION STAGE

The questions had been asked to the respondents regarding the current system compared with the system being developed.

4.6 PIECES ANALYSIS STAGE

The questions that have been collected will be used to calculate an average assessment of respondents' satisfaction with performance, information, economy, control and efficiency, and services—all of which are explained by the formula. On a Likert scale, respondents choose the response that most closely expresses their viewpoint. One typical method of assessing respondents' attitudes is to ask them to rate how much they agree or disagree with a certain problem or statement. According to Joshi, Ankur & Kale, Saket & Chandel, Satish & Pal, and Dinesh (2015), the original Likert scale is a set of statements (items) offered for a real or hypothetical situation under study. Participants are asked to show their level of agreement (from strongly disagree to strongly agree) with the given statement (items) on a metric scale. During analysis, the scores of all items of the questionnaire are combined (sum) to generate a composite score, which logically, in totality, measures a one-dimensional trait. Hence, according to Ahmad Fatoni, Kusworo Adi, and Aris Puji Widodo (2020), the PIECES Framework method is a framework containing the categories of classification and problem-solving problems. The classification is divided into six categories according to the sequence: performance, information and data, economics, control and security, efficiency, and services. In addition, the PIECES Framework method is also a framework used to classify problems, opportunities, and directives contained in the scope definition of analysis and system design. With this skeleton, it can generate new things that can be considered in developing the system.

Information:

RK = Mean or average satisfaction $RK = \frac{JK}{N}$

JK = Total score of the questionnaire

N = Number of respondent

In finding the percentage of the data gathered from the respondents used the following formula**:**

$$\% = \left(\frac{f}{N}\right) * 100$$

Where:

% = Percent

f = Frequency

N = No. of Cases

Table 1. Likert Scale

Numerical Value	Range	Interpretation
5	4.51 – 5.0	Very Satisfied
4	3.51 – 4.50	Satisfied
3	2.51 – 3.50	Doubtful
2	1.51 – 2.50	Not Satisfied
1	1.00 – 1.50	Very Dissatisfied

Table 1. The mean or average satisfaction values obtained are matched with the satisfaction level criteria

4.7 SYSTEM EVALUATION FROM ANALYSIS RESULTS

PIECES Framework was used to classify a problem, opportunities, and directives contained in the scope of analysis and system design section.

Variable	Statement

Performance	Performance is a collection of systems for completing tasks quickly so that goals can be achieved immediately. Indicators that affect: Throughput, Response time, Audibility, Common Communication, Completeness, Consistency, and Fault Tolerance
Data and Information	Information is important because, with this information management, users can take the next steps. If the ability of the information system is good, then the user will get accurate, timely, and relevant information as expected. Indicators that affect: Accuracy, Relevance of Information, Presentation of Information and data flexibility
Economics	Utilization of costs from the use of information. The increase in the need for economic information can affect cost control and increase the benefits of the information system. Indicators that affect: reusability, resources
Control and Security	This analysis is used to compare the analyzed systems based on the aspects of system integrity, ease of access, and data security: Integrity, Security
Efficiency	Efficiency relates to how these resources can be used optimally. Operations in a company are said to be efficient or not, usually based on tasks and responsibilities in carrying out activities. Indicators that affect usability and maintainability
Services	Systematic services can be done quickly and easily

Table 2. PIECES Framework Statement List

5. RESULTS AND DISCUSSION

In the implementation of this system, the authors use the MYSQL database, bootstrap framework, and Materialize CSS in designing a responsive and user's friendly interface.

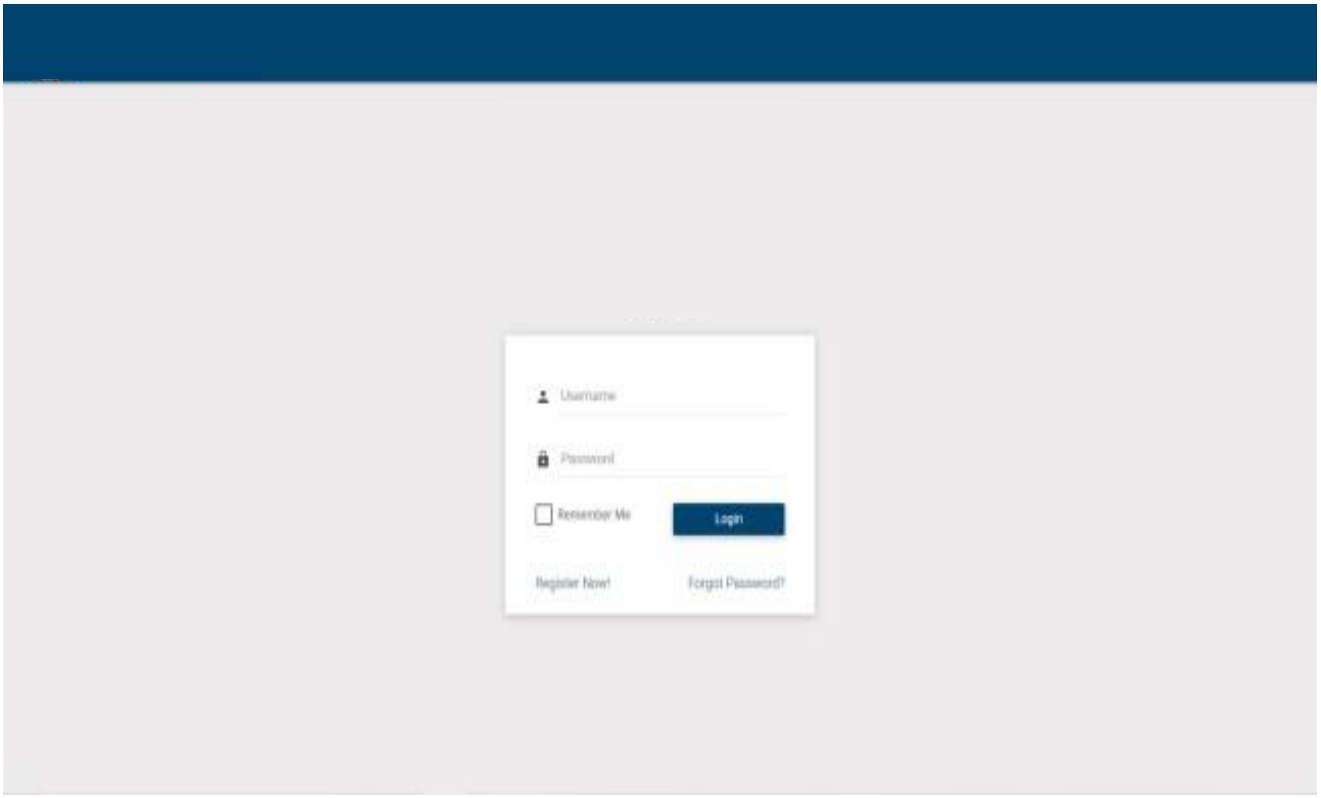

Figure 3. Log In Page –

Users login to apply for a scholarship

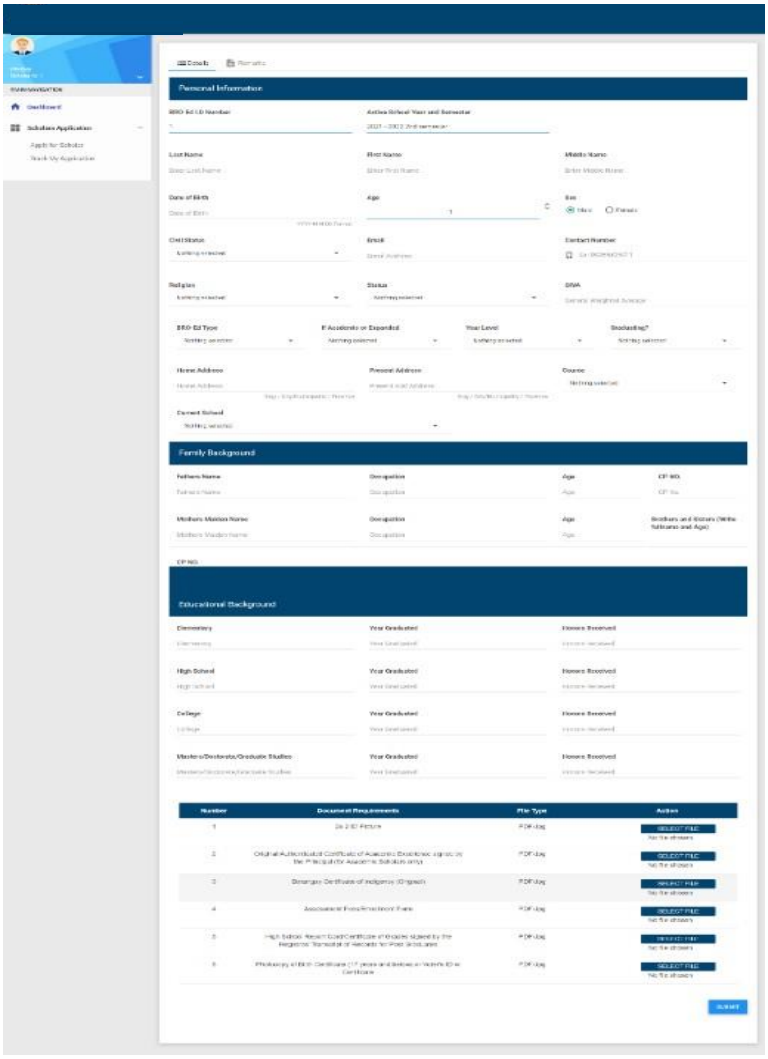

Figure 4. Application of Scholarship
Users client to apply scholar in this form

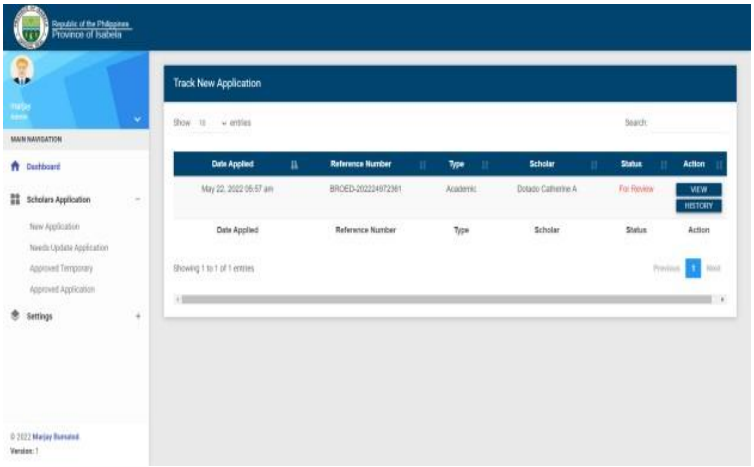

Figure 5. Received Application in Admin Account

User admin can view submitted and manage records of scholars.

This table presents the analysis and interpretation of the data gathered. The main objective was to find out the expectations and evaluations of the respondents about the existing and proposed systems of the scholars. The respondents of this research were scholars and were randomly selected. The PIECES framework serves as the basis for the questionnaire to gather relevant information.

Table 3. Summary of evaluation on the user's satisfaction level in using manual system.

Description	Weighted Mean	Interpretation
Performance	3.18	Doubtful
Information/Data	3.40	Doubtful
Economics	3.34	Doubtful
Control and Security	3.36	Doubtful
Efficiency	3.25	Doubtful
Services	3.29	Doubtful
Grand Mean	**3.30**	**Doubtful**

The respondents' overall assessment of the manual system is displayed in Table 3. The manual system was rated with a grand mean of 3.30, understood as "doubtful," out of all the criteria, with "Information/Data" receiving the greatest mean of 3.40, interpreted as "doubtful," and "Performance" receiving the lowest mean of 3018, read as "doubtful." Bailey V. (2019) argues that while being involved in every aspect of your organization is beneficial, it isn't necessarily applicable to all stages of operations. One important area of the company where switching to automated procedures is nearly always preferable is data entry. Although switching to an automatic system can facilitate more seamless operations, it may still make sense to perform all data entry manually in extremely small enterprises when the owner serves as the primary operator.

Table 4. Summary of evaluation on the user's satisfaction level in the proposed system.

Description	Weighted Mean	Interpretation
Performance	4.31	Satisfied
Information/Data	4.53	Very Satisfied
Economics	4.50	Satisfied
Control and Security	4.54	Strongly Agree
Efficiency	4.36	Satisfied
Services	4.40	Satisfied
Grand Mean	**4.44 or 88%**	**Satisfied**

Table 4 shows the overall evaluation of the respondents on the online scholarship grant. Among all the criteria, "Control/Security: obtained the highest mean of 4.54, which is interpreted as "strongly agree," and the lowest one is "Performance," with a mean of 4.31, interpreted as "agree" for its interpretation. Overall, the proposed system was rated as "satisfied" with a grand mean of 4.44. However, Lampson B. says that people have been inventing new ideas in computer systems for nearly four decades, usually driven by Moore's law. Many of them have been spectacularly successful: virtual memory, packet networks, objects, relational databases, and graphical user interfaces are a few examples.

6. CONCLUSION

As to the analysis made in this study, the researcher found out that using manual operations has problems in terms of performance, information and data, economics, control and security, efficiency, and services. Sometimes the recording process is not followed, which results in consuming more time in inputting or writing information; records are kept in folders and filed in a cabinet but cannot be easily retrieved when needed; and reports are not available on time because of a lack of systematic procedures and difficulties in preparing the needed data. The researcher proposed an online scholarship grant to speed up the process of generating accurate, efficient reports and to answer the problems encountered by the users.

7. RECOMMENDATIONS

Based on the conclusion, it is highly recommended that scholars be encouraged to use the developed system, for it provides accuracy, efficiency, and reliability that will fix the problems encountered in recording and filing scholarship records. Future researchers will recommend the system by adding features as needed and conducting further studies on the efficiency of the proposed system.

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