

STEM WEB-BASED SYSTEM FOR STUDENTS' PROFILING AND ARCHIVING OF THESIS AND CAPSTONE PROJECTS

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ABSTRACT

This study developed a STEM Web-Based System for Students' Profiling and Archiving of Thesis and Capstone Projects. It utilized Rapid Application Development (RAD) and a descriptive approach to attain the objectives. The researchers used the adopted but modified protocol from Roger C. Gimena (2022) in developing the web-based system. Thereafter, the researchers subjected it to a series of testing and evaluation. It was revealed that the web-based system showed exceptional speed and accessibility. The three (3) gadgets used in the testing of speed and accessibility vary significantly different. The tablet (Samsung Galaxy Tab A8) indicated the fastest response to the command of searching, logging in, and downloading files from the web-based system. On the other hand, the cellphone (Oppo A9 2020) exemplified the fastest response to accessing the web-based system's user profile and gallery, while the laptop (Acer Aspire E6 – 475G) demonstrated the fastest response to the command of launching the thesis and capstone project page. Furthermore, the student users and the web-based system administrators evaluated the system to be highly functional, reliable, usable, efficient, maintainable, and portable as evidenced by the overall mean of 4.73 (x=4.73), 4.63 (x=4.63), 4.63 (x=4.63), 4.54 (x=4.54), 4.66 (x=4.66), and 4.76 (x=4.76), respectively. Therefore, the researchers recommend that other brands of gadgets and WIFI telecom providers may be utilized for comparative analysis of results. Also, they suggest that a system administrator may be assigned to maintain the database and update it every academic year using the manual for managing and using the system.

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KEYWORDS: accounts, accessibility, administrator, archiving system, capstone projects, developing a web-based system, rapid application development, efficiency, encoder, functionality, maintainability, portability, profiling system, reliability, speed, stem alums, thesis, usability, users.

INTRODUCTION

The Web in today's time supplies everyone with crucial information. It has given vast opportunities to educational institutions like schools and colleges. We are now in a new era where education mainly relies on modernization, from manually scanning books in the library to browsing the Internet, from writing data to recording information to showing a visual presentation of reports.

As we pass by different generations, technological evolution also takes place, enabling us to do our tasks more efficiently and effectively with the help of advanced technology. It provides countless online resources for the students to use, allowing them to browse and learn more. STEM strand requires its students to find numerous references and citations from valid and reliable authors whose studies could be of great help to them, especially in their related literature and studies of their current research.

Hence, the advent of technology significantly amended the struggles that the students like STEM might face in their studies. Looking for a reference for their capstone and thesis writing tasks remains their challenge since the project and research outputs of the STEM alums are not readily available for their use as references because these materials were not numerous reproduced and even immediately available due to unsystematized keeping. Furthermore, the profiling of the STEM students, either currently enrolled or alums, still needs to be departmentalized; hence, this study proposes designing a web-based system that addresses these departmental needs.

OBJECTIVES OF THE STUDY

This study developed a STEM Web-Based System for Students' Profiling and Archiving of Thesis and Capstone Projects.

Specifically, the researchers performed the following tasks:

- Developed a STEM Web-Based System for Students' Profiling and Archiving Thesis and Capstone Projects;
- 2. Tested the developed STEM Web-Based System regarding its speed and accessibility; and
- 3. Subjected the developed STEM Web-Based System to the evaluation of STEM students, selected IT experts, and teachers in terms of:
- 3.1 Functionality;
- 3.2 Reliability;
- 3.3 Usability;

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3.4 Efficiency;

3.5 Maintainability; and

3.6 Portability.

RESEARCH QUESTIONS

Guided by the objectives of the study, the researchers answered these subsequent scientific questions:

- 1. How was a STEM Web-Based System for Students' Profiling and Archiving of Thesis and Capstone Projects developed?
- What is the average speed and accessibility of the developed STEM Web-Based System for Students' Profiling and Archiving of Thesis and Capstone Projects after the three (3) trials concerning:
 - 2.1 Searching the Web Using Google;
 - 2.2 Logging in the Web Using Google;
 - 2.3 Accessing the Profile Page;
 - 2.4 Accessing the Gallery;
 - 2.5 Accessing the Thesis/Capstone Page; and
 - 2.6 Downloading of Thesis/Capstone Files?
- 3 What is the functionality, reliability, usability, efficiency, maintainability, and portability of the developed STEM Web-Based System for Students' Profiling and Archiving of Thesis and Capstone Projects as evaluated by the STEM students, selected IT experts, and teachers?

SCOPE AND DELIMITATIONS OF THE STUDY

This study developed a web-based system that preserves studies, previous works, and the profiles of the currently enrolled STEM students and STEM alums. The researchers conducted this study in Colon National High School in *2022 – 2023*. The STEM Web-Based System for Students' Profiling and Archiving of Thesis and Capstone Projects is a web-based system that requires a desktop computer, laptop, tablet, or any smartphone and runs on a web browser. In developing the Web-based System, the researchers used an adopted but modified protocol from Mr. Roger C. Gimena (2022). The adopted protocol includes the usage of the following system requirements in the successful development of the STEM Web-Based System for Students' Profiling and Archiving of Thesis and Capstone Projects: HTML, CSS, JavaScript, PhpMyAdmin, XAMPP, Visual Studio Editor, and MySQL.

After the researchers has successfully developed the STEM Web-Based System for Students' Profiling and Archiving of Thesis and Capstone Projects was then subjected to speed and accessibility testing in terms of searching the web-based system using Google as the search engine, logging in to the web-based system, accessing the profile page, accessing the gallery page, accessing the thesis and capstone page, and downloading the files. To successfully do this comparative testing of speed and accessibility, the researchers used three (3) gadgets, i.e., Galaxy Tab A8, Oppo A9 2020, and Acer - Aspire E5-457G. They performed three (3) trials in each test and determined its average.

The Web-based System has also been a subject for evaluation by STEM Students as user, and as well as Teachers and selected I.T. Experts as the system administrators. They are instructed to evaluate the system's activity scheme according to their usage.

LIMITATIONS OF THE STUDY

This research, however, is subject to several limitations. These include the researchers' use of Globe Telecoms as their wireless fidelity (WIFI) provider since this telecom has the greatest signal strength in the area compared to other telecom companies like Smart and Dito. Hence, other WIFI providers may be used by future researchers to compare the results of speed and accessibility further. Moreover, the gadgets used for testing the speed and accessibility were limited only to Samsung Galaxy Tab A8, Oppo A9 2020, and Acer - Aspire E5-457G. There are also other brands or models of gadgets that the researchers may have used; however, due to the availability of these other gadgets, the researchers resorted to using the said gadgets.

Lastly, when the researchers conducted the testing, the location was limited to the corridor of the senior high school building where the STEM strand rooms are located. The researchers could have explored other places to try out the speed and accessibility of the web-based system. However, because of time constraints, they resorted to staying in the corridor of the senior high school building.

SIGNIFICANCE OF THE STUDY

Technology Development. This study imposes an alternative to new technology in line with the advancement and evolution of technology. Allowing users to work efficiently and creating a stepping stone in the evolution of technology in a way that allows future researchers to make further innovations from this study.

Policy Implications. The study nurtures the capabilities of the researchers, in the way of optimizing their skills in order for them to achieve a certain goal. In this study, researchers are nurtured in terms of developing and providing a web-based system that is beneficial to the STEM Students and faculty of Colon National High School.

Community. This study introduces the innovation of technology as one of the major aspects that can affect our daily lives here in our community. The study implies an innovation or rather an alternative to what we are used to but in a more efficient manner.

Teachers and Admins of a Web-Based System. This study helps the research teachers of STEM to facilitate the tracking of students' profiles and give online references to the current STEM students. The study may also provide teachers an avenue to address the gaps explained in this present study so that when future STEM researchers dwell on the same focus, they may be guided on how to enhance the developed web-based system.

STEM Students. This study could be an eye-opener for STEM students in terms of innovations, especially in terms of technology as this is one of the specialties of our strand. This study could serve as the basis for their future studies if they want to pursue research in the field of technology.

RESEARCH GAP

Little research reviewed the web-based system's importance in education, mainly research and capstone making. Finding numerous references and citations from valid and reliable authors whose studies could help establish research is a gap from other existing research that the researchers saw and needs to be addressed. Therefore, developing a web-based system specifically for students facing the said struggle is a crucial advancement, especially for those who will benefit.

In the current study of Mr. Michael M. Orozco, MIT (2016), the specification in terms of population is only limited to the faculties. Hence, the current researchers filled in the gap by considering both students and faculties as the beneficiaries of the research, along with the IT experts who formed part of the evaluators of the developed Web-based system.

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CONCEPTUAL FRAMEWORK



METHODOLOGY

This study employed Rapid Application Development (RAD) in developing the STEM Web-Based System for Students' Profiling and Archiving of Thesis and Capstone Projects and adopted but modified the protocol from Roger C. Gimena (2022). According to Kissflow (2023), RAD is the best approach to develop prototypes swiftly for testing software functionalities without worrying about any effects on the end product.

On the hand, the quantitative method, mainly the descriptive design, was used in determining the testing results of the web-based system's speed and accessibility and in determining the evaluation results of the web-based system in terms of its functionality, reliability, usability, efficiency, maintainability, and portability as evaluated by the selected IT experts, STEM students, and teachers. According to McCombes (2019), the descriptive type of research is an appropriate choice when the research aims to identify characteristics, frequencies, trends, correlations, and categories.

SYSTEM REQUIREMENTS

Visual Studio Code served as the central system for the Web. A free, installation-free Visual Studio Code experience that runs entirely in a browser, allowing the researchers to quickly and safely browse source code relocations and make simple code changes. Further, XAMPP helped the researchers test their website across computers and laptops before releasing it on their local host or server on the central server.

Additionally, JavaScript was used to control the behavior of various elements, while CSS was used to regulate presentation, formatting, and layout. When building a database for data storage and manipulation, MySQL protects the relationships between each table. The researchers could submit requests by typing a specific SQL statement into MySQL. The server application will respond with the requested data, appearing on the researchers' side. The researchers may manage their Maria Db database(s) using PhpMyAdmin, an open-source utility pre-installed with their web hosting plan. The researchers could import, export, optimize, or drop tables in PhpMyAdmin. If their website uses a database, all their data is kept in it.

EQUIPMENT

A laptop or desktop technology was used to easily access and store information, data, and multimedia content and download information from the Web.

PARAPHERNALIA

The face mask was used to protect the researchers from the virus since the country was still recovering from the pandemic, so wearing a face mask was necessary. Lastly, anti-radiation glasses protected the researchers from the radiation the desktop/laptop emitted.

PROCEDURE

The researchers adopted the protocol from Mr. Roger C. Gimena (2022) but modified it to suit the purpose of the present study. In developing the web-based system, the researchers followed these procedures.

First, they gathered all the necessary system requirements such as CSS, HTML, JavaScript, Visual Studio Editor, XAMPP, MySQL, PhpMyAdmin, equipment like desktop, laptop, tablet, and paraphernalia such as anti-rad glasses and face mask. Second, they turned on the desktop and opened the browser. Third, they launched Visual Studio Editor to edit computer languages. Fourth, they opened the XAMPP to create the web system in a local web server. Fifth, they developed the front end of the Web-Based System, which includes the HTML that provides the basic structure of the web-based system and CSS that controls the presentation, formatting, and layout. JavaScript controls the different behavior in the Web-based system. Sixth, they developed the backend, i.e., MySQL- this computer language allows the researchers to store and access information. Lastly, the PhpMyAdmin interprets and operates called in or edited in the PHP script.

VARIABLES OF THE STUDY

The study's independent variable is the developed STEM Web-Based System for Students' Profiling and Archiving of Thesis and Capstone Projects. The dependent variables are speed, accessibility, functionality, reliability, usability, efficiency, maintainability, and portability.

STATISTICAL TOOLS

In determining the average speed and accessibility, functionality, reliability, usability, efficiency, maintainability, and portability of the developed web-based system, Weighted Mean was used.

RESULTS AND DISCUSSIONS

A.) Development of the Web-Based System

The STEM Web-Based System for Students' Profiling and Archiving of Thesis and Capstone projects was developed using the adopted but modified protocol. It started with gathering equipment, i.e., desktop and laptop and paraphernalia, and downloading the required system applications, i.e., Visual Studio Code and XAMPP. Then, the researchers opened the Visual Studio Code and edited the different codes in each programming language. The codes were edited based on the selected theme, which was

astronomy. Next, the researchers developed the front-end using HTML, CSS, and JavaScript. For the backend, phpMyAdmin and MySQL were utilized.

Brewster (2023) states that front-end and back-end web development technologies are used to create web applications. Theoretically, web apps are closely related to websites; consequently, web app development and website development share many similarities. On the front end, web app developers utilize JavaScript, CSS, and HTML, among other technologies. Similar server-side programming languages, such as Ruby or Python, could be used for the backend of web applications. Nevertheless, web apps operate on any device in a manner distinct from a conventional website.

Further, web-based systems offer numerous benefits, including portability. The web system is accessible from any device. Web systems are essentially entirely cross-platform. As long as users maintain an internet connection, they provide users with an entertaining exchange regardless of their operating system, be it Android, iOS, PC, etc. (Brewster, 2023).

It is also more practical. Web-based systems do not require downloading and installation. Alternatively, in the case of PWAs, the download and installation would not equate to the app occupying space; even though the fact that smartphones appear to be increasing their storage space in what appear to be squared increments, some people do not like the bloat of having many apps or do not have the space (Brewster, 2023).

Figures 1 to 4 show the homepages and activity flow of the developed web-based system for administrators and users.



Figure 1. Web-Based System Homepage for Admin

Process in Using the Web-Based System for Administrators

The admin, i.e., the research teachers of STEM, will be the ones to encode the thesis and capstone outputs of the STEM students in the interface for admin. The admin's activity flow is demonstrated on the next page in Figure 2



Figure 2. The Admin Activity Flow

The above figure illustrates the duties of the admin. First, the admin will create his/her account to access the web. Second, the admin will log in to his/her account to explore the homepage of the web system. Third, the admin will perform his/her three (*3*) duties, i.e., profile the STEM students, update the gallery, and encode the thesis and capstone outputs of the students. Fourth, the admin needs to encode STEM students' details in profiling the students. Once done, the admin will individually generate the accounts for the students.

Fifth, in updating the gallery, the admin needs to insert photos of the best practices of the strand. Sixth, in archiving the thesis and capstone projects of the students, he/she will encode the soft copies of the research and make it accessible and downloadable for the student users upon their access to the files. When these three (3) duties are accomplished, the admin has to log out of his/her account from the web system. Simply put, these procedures are repetitive, and the admin is responsible for monitoring the web system, troubleshooting the issues encountered, and updating the files and information from time to time.

This is agreed by Sarangabany (2018), who averred that web administrators create, develop, maintain, and fix websites. Most importantly, they guarantee a secure and productive user experience. This may involve implementing security protocols, modifying programs, creating backups, resolving software issues, and updating content, among other activities. They may design, program, and monitor websites for multiple clients or a single organization. Specific responsibilities include coding websites in

HTML and JavaScript, collaborating with development teams to program websites, establishing tools to monitor website traffic, analyzing website traffic to inform design decisions, and addressing usability concerns.

Further, web administrators must possess both technical and interpersonal skills. A foundational understanding of systems, servers, and security will aid web administrators in designing and troubleshooting efficient websites (Sarangabany, 2018).



Figure 3. Web-Based System Homepage for User

Process in Using the Web-Based System for User

The users, i.e., STEM students, most benefit from this web-based system. By having an account to log in to STEM Gerniey Portal, they may have the opportunity to explore the web-based system concerning their profile, the gallery for best practices of the strand, and access to the thesis and capstone projects of the previous STEM students. If they are alums of the strand, they are advised to request the admin for their accounts to access the portal. Once they have secured their account, they can access the portal to revisit their previous studies. Indeed, developing a STEM Web-based System for Students' Profiling and Archiving of Thesis and Capstone is essential to teachers and students.

This is supported by Quora (2023)'s assertion that Web systems and applications play an essential role in education by providing students and teachers with various online learning and teaching resources and tools. These systems and applications can help to make educational content more accessible. Anywhere with an internet connection, students and teachers can access educational materials such as online courses, lectures, and textbooks. Moreover, web-based applications and systems facilitate

collaboration and communication. Web-based systems and applications enable teachers and students to communicate and collaborate in real time, fostering a more interactive and engaging learning environment.

Additionally, it enhances the individualization of learning. Web-based systems can monitor student profiles and provide individualized recommendations for further study, enabling students to tailor their education to their specific needs and interests. Overall, web-based systems and applications are integral to contemporary education, as they improve access to educational resources and facilitate more efficient teaching and learning (Quora, 2023).

The user's activity flow is demonstrated below in Figure 4.



Figure 4. The User Activity Flow

The above figure illustrates the user activity. To access the STEM Web-Based System for Students' Profiling and Archiving of Thesis and Capstone, the student-user will first ask the admin for his/her generated account. Once given, the student-user will log in to the website, and the homepage for users appears. Then, he/she will be presented with three *(3)* options, i.e., to explore the gallery, view his/her profile, or visit the thesis and capstone menu bar for research resources. When he/she explores the profile, he/she will get to see his/her details; however, limited actions he/she may only perform include editing his/her personal information and profile pictures. Other modifications are restricted to the admin's duties.

Moreover, when the student-user opens the gallery, he/she can browse the photos as best practices of the strand, but he/she cannot edit the photos. He/she can download the photos instead. Similarly, when the user visits the thesis and capstone section, he/she will be presented with an array of studies conducted by the STEM alums. These files are in portable document format (PDF) and are downloadable anytime as long as the user is connected to the internet. When the user is done exploring the interface, he/she has to log out from the web system. This scheme of the user is repetitive.

According to TechTarget (2023), web-based systems do not need to be downloaded since they are accessed through a network. Users can access a web-based system through a web browser, such as Google Chrome, Mozilla Firefox, or Safari. For a web-based system to operate, it needs a web server,

application server, and database. Web servers manage the requests that come from a client while the application server completes the requested task. A database stores any necessary information.

The web-based system typically has short development cycles and small development teams. Developers write most web-based systems in JavaScript, HTML*5*, or CSS. Client-side programming typically utilizes these languages, which help build an application's front-end. Server-side programming creates the scripts a web app will use. Languages such as Python, Java, and Ruby are commonly used in server-side programming (TechTarget, 2023).

Speed and Accessibility Testing of the Web-Based System

This study had undergone speed and accessibility testing of the web-based system for three (3) consecutive trials. A Globe Telco WIFI modern was used as the internet source of all the testing gadgets to determine the speed of accessing the web-based system regarding its various functions. Google Chrome was used as the search engine, and three (3) different kinds of gadgets were used which were: a cellphone (Oppo A9 2020), a tablet (Samsung Galaxy Tab A8), and a laptop (Acer Aspire E5 – 475G). All series of testing was made and done on March 14, 2023. The results shown in the following tables on the succeeding pages correspond to the various speed and accessibility testing conducted by the researchers.

 Table 1. Testing the Speed and Accessibility of the Web-Based in terms of Searching the Web-Based Using Google Chrome as the Search Engine

GADGETS	T1	T2	Т3	AVERAGE
Tablet (Samsung Galaxy Tab A <i>8</i>)	0.71s	0.73s	0.98s	0.81s
Cellphone (Oppo A <i>9 2020</i>)	2.34s	1.14s	2.26s	1.91s
Laptop (Acer Aspire E <i>5</i> – 475G)	1.61s	1.39s	1.22s	1.41s
AVERAGE		1.	38s	1

Legend: 0.81s – 1.02s (Very Fast), 1.28s – 1.91s (Fast), 2.13s – 2.79s (Moderately Fast), 3.35s – 4.02s (Slow), 4.60s – 5.25s (Very Slow)

The results show that the tested web-based system yielded **fast speed and accessibility**, as evidenced by the average of *1.38* seconds from all the gadgets tested. Specifically, the results of the testing show different average speeds in different gadgets in terms of searching the web-based system using Google Chrome as the search engine, with an average of *0.81* seconds (Very Fast) for the tablet (Samsung Galaxy Tab A8), *1.91* seconds (Fast) for the cellphone (Oppo A9 2020), and an average of *1.41* seconds (Fast) for the laptop (Acer Aspire E5 – 475G) for the three (3) gadgets that used the same internet connectivity at the same time and place.

Therefore, among the three gadgets used during the testing, the tablet (Samsung Galaxy Tab A8) yielded the fastest searching speed and accessibility among any other gadgets used.

Implications

With the results yielded by the testing, it is denoted that the tablet with the specified Samsung Galaxy Tab A8 model appeared to be the fastest gadget to deliver the requested action. Samsung Galaxy Tab A8 supports the WIFI connectivity standard 802.11 a, 802.11 b, 802.11 g, 802.11 n, and the latest WIFI standard 802.11 ac (Samsung, n.d.) offers an internet speed rate of 54 Mbps to 1300 Mbps. The Samsung Galaxy Tab A8 supports 2.4 GHz and 5 GHz internet bandwidth (Samsung, n.d.), and a device that supports both 2.4 GHz and 5 GHz is considered Dual Band (Homenet Howto, n.d.).

Simultaneous Dual Band allows two WIFI networks to function simultaneously using 2.4-GHz and 5-GHz frequency bands. Aside from doubling the amount of the available bandwidth, it also allows a more reliable dedicated WIFI network for video and gaming (*5*GHz) to be created. When connecting multiple gadgets, having two separate wireless networks avoids overcrowding and interference and allows more flexibility to make the best possible connection (NETGEAR, 2023). It also has the VHT*80* (Very High Throughout *80*), allowing it to cater to radio signals through a contiguous *80* – MHz channel (Plume Glossary, 2023).

Table 2.	. Testing the Speed and Accessibility of the Web-Based in terms of	Logging-In the Web-
	Based Using Google Chrome as the Search Engine	

GADGETS	T1	T2	Т3	AVERAGE
Tablet (Samsung Galaxy Tab A <i>8</i>)	2.18s	1.44s	1.64s	1.75s
Cellphone (Oppo A <i>9 2020</i>)	1.74s	4.83s	3.49s	3.35s
Laptop (Acer Aspire E <i>5</i> – <i>475</i> G)	2.39s	5.86s	3.81s	4.02s
AVERAGE		•	3.04s	

Legend: 0.81s – 1.02s (Very Fast), 1.28s – 1.91s (Fast), 2.13s – 2.79s (Moderately Fast), 3.35s – 4.02s (Slow), 4.60s – 5.25s (Very Slow)

Table 2 reveals that the three (3) gadgets tested generally show an average speed and accessibility of 3.04 seconds, indicating a **slow speed and accessibility** performance of the web-based system. Remarkably, the gadgets used vary in average speed and accessibility when testing its logging-in process using Google Chrome as the search engine. Tablet (Samsung Galaxy Tab A8) yielded an average of 1.75 seconds (Fast), a Cellphone (Oppo A9 2020) garnered an average of 3.35 seconds (Slow), and a laptop (Acer Aspire E5 – 475G) consumed an average of 4.02 seconds (Slow).

In conclusion, the tablet (Samsung Galaxy Tab A8) yielded the fastest average speed and accessibility when it comes to the logging-in process of the web-based among any of the other gadgets that the researchers used during the testing.

Implication

The given results imply that the speed and accessibility of the web-based system vary significantly among the gadgets used. Although there is quite a more significant disparity in time, i.e., in seconds among the gadgets, this time disparity may change depending on the strength of the internet connectivity or WIFI provider and the location of the testing. However, considering these gadgets being utilized, it could be construed that the tablet, specifically the Samsung Galaxy Tab A8 model appeared to be the fastest gadget to carry out the requested action and is suggested to be used by the student users for faster logging in the web-based system.

Further, these results contrast the results of the study conducted by Compuware APM (2013), a Web optimization company. According to them, tablet owners are disappointed in the web surfing aspects of their devices because sites are not opening as fast as they expect. The study, conducted by Equation Research (2013) and commissioned by Compuware APM, was based on interviews with *2,033* people from January *5* to *16*, 2013. It focused on people who owned a tablet and had used it to surf the Internet over the past six months. Compuware ARM says the survey results, conducted worldwide, can safely be projected onto the rest of the world with *95* percent accuracy. The *15*-page report is a great read, as there are several interesting tidbits, including that: *41* percent of tablet users have experienced slow load times and crashes, poor page formatting, and other issues. Seventy (*70*) percent of tablet users expect websites to load as fast, if not faster, than on their home computers. Thirty-four (*34*) percent of tablet users have a *404* error while accessing a website. Indeed, the study has many statistics, but two significant trends prevail: Companies are still in shock over how quickly tablets caught on, and users already expect tablets to give them at least the same performance as their home computers.

Page of the web-based Using Google Chrome as the Search Engine				
GADGETS	T1	T2	Т3	AVERAGE
Tablet (Samsung Galaxy Tab A <i>8</i>)	1.23s	1.24s	2.61s	1.69s
Cellphone (Oppo A <i>9 2020</i>)	1.24s	1.51s	1.43s	1.39s
Laptop (Acer Aspire E <i>5</i> – <i>475</i> G)	1.79s	1.36s	1.38s	1.51s
AVERAGE			1.53s	

Table 3. Testing the Speed and Accessibility of the Web-Based in terms of Accessing the ProfilePage of the Web-Based Using Google Chrome as the Search Engine

Legend: 0.81s – 1.02s (Very Fast), 1.28s – 1.91s (Fast), 2.13s – 2.79s (Moderately Fast), 3.35s – 4.02s (Slow), 4.60s – 5.25s (Very Slow)

The results shown in Table 3 depict the results of the tested web-based system in accessing the profile page with Google Chrome as the search engine generated in three (3) different gadgets. Generally, the average result of the gadgets used is 1.53 seconds, indicating **fast speed and accessibility**. This mainly details that a tablet (Samsung Galaxy Tab A8) depicted an average of 1.69 seconds (Fast), a

cellphone (Oppo A9 2020) garnered an average of 1.39 seconds (Fast), and a laptop (Acer Aspire E5 – 475G) reflected an average of 1.51 seconds (Fast).

To conclude, the fastest gadget, determined by the shortest time consumed upon accessing the profile page of the Web-based system, is the cellphone (Oppo A9 2020).

Implication

Reflected by the results yielded by the testing, the cellphone with the specific brand and model of Oppo A9 2020 came out to be the quickest in accessing the web-based system's profile page. According to Internet Packages (2023), people are more likely to use their phone for processing, but it has lower maximum power output. The WIFI speeds on the phone are twice as fast as on the laptop. However, the battery life is shorter because it uses more power. A recent study found that the WIFI speeds on a phone are twice as fast as on a laptop. This is due to various factors affecting WIFI performance, such as distance from the router, interference from other devices, and building materials. In addition, while laptops have been designed with heat generation in mind, phones have not. This means that a smartphone's processing power will cause it to generate more heat and affect its WIFI performance.

Further, Mills (2021) explains why WIFI goes faster on a smartphone than on a computer may be due to a simple error in the configuration. Thus, it may be that the computer is connected to the 2.4 GHz band, which is slower, instead of the 5 GHz band. Then, a person can connect to it, for which he/she will have to enter the password if he/she has not done it before. This failure is typical when a person is relatively close to the router.

Additionally, in an analysis of various gadgets, the Federal Communications Commission (FCC) (2022) found that cell phones, on average, had about an *18* Mbps download rate over WIFI networks, while laptops only had *9.5* Mbps on average. This discrepancy is attributed to the larger antennae of cellphone gadgets and their ability to focus more energy toward a target receiver.

Table 4. Testing the Web-Based in terms of Accessing the Gallery Page of the Web-Based UsingGoogle Chrome as the Search Engine

GADGETS	T1	T2	Т3	AVERAGE
Tablet (Samsung Galaxy Tab A <i>8</i>)	2.62s	1.27s	1.19s	1.69s
Cellphone (Oppo A9 2020)	1.14s	1.06s	0.87s	1.02s
Laptop (Acer Aspire E <i>5</i> – 475G)	1.72s	1.36s	1.34s	1.47s
AVERAGE		1	.39s	•

Legend: 0.81s – 1.02s (Very Fast), 1.28s – 1.91s (Fast), 2.13s – 2.79s (Moderately Fast), 3.35s – 4.02s (Slow), 4.60s – 5.25s (Very Slow)

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The results in Table 4 show the web-based system's average speed upon accessing its gallery from different gadgets. The three (3) gadgets generated an average of 1.39 seconds, signifying **fast speed and accessibility**. In other words, the tablet (Samsung Galaxy Tab A8) yielded a total average of 1.69 seconds (Fast), and the cellphone (Oppo A9 2020) yielded a total average of 1.02 seconds (Very Fast). The laptop (Acer – Aspire E5 – 475G) yielded an average speed of 1.47 seconds (Fast) after three (3) consecutive testing.

Simply put, the cellphone (Oppo A9 2020) is identified as the fastest gadget to access the gallery of the web-based system among the gadgets used during testing.

Implication

According to the test findings, the Oppo 2020 smartphone was the fastest to access the web-based profile page. Internet Packages (2023) indicates that people are more likely to use their phones for processing, despite having a lower maximum power output. Smartphone WIFI speeds are twice as fast as laptop WIFI speeds. However, the battery life is shorter due to the increased power consumption. According to a recent study, the WIFI speeds on a smartphone are twice as fast as on a laptop. This is due to various factors impacting WIFI performance, including distance from the router, interference from other devices, and construction materials. In addition, laptops were designed to generate heat, whereas mobile devices were not.

This means that the processing power of a smartphone will cause it to generate more heat, which will negatively impact its WIFI performance. In addition, Mills (2021) explains that WIFI is faster on a smartphone than on a computer because of a simple configuration error. Thus, the computer may be connected to the slower 2.4 GHz band rather than the 5 GHz band. Then, a user can connect to it, for which he or she will need to enter the password for the first time. This failure is typical when the user is close to the router. In addition, the Federal Communications Commission (FCC) (2022) found that cell phones had an average download speed of 18 Mbps over WIFI networks, whereas laptops had an average download speed of 9.5 Mbps. This disparity can be attributed to the larger antennae of mobile devices and their ability to concentrate more energy on the target receiver.

T1	T2	Т3	AVERAGE
1.34s	1.38s	1.24s	1.32s
1.30s	3.79s	1.30s	2.13s
1.34s	1.37s	1.13s	1.28s
	1	.58s	1
	T1 1.34s 1.30s 1.34s	T1 T2 1.34s 1.38s 1.30s 3.79s 1.34s 1.37s	T1 T2 T3 1.34s 1.38s 1.24s 1.30s 3.79s 1.30s 1.34s 1.37s 1.13s 1.58s

Table 5. Testing the Speed and Accessibility of	f the Web-Based in terms of Accessing the
Thesis/Capstone Page of Web-Based Using	g Google Chrome as the Search Engine

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Legend: 0.81s – 1.02s (Very Fast), 1.28s – 1.91s (Fast), 2.13s – 2.79s (Moderately Fast), 3.35s – 4.02s (Slow), 4.60s – 5.25s (Very Slow)

It can be construed from Table 4.5 that the three (3) gadgets used in testing yielded an overall average of 1.58 seconds, indicating **fast speed and accessibility** in launching the thesis/capstone projects section in the web-based system. Specifically, the tablet (Samsung Galaxy Tab A8) obtained an average of 1.32 seconds (Fast), the cellphone (Oppo A9 2020) garnered an average of 2.13 seconds (Moderately Fast), and the laptop (Acer Aspire E6 – 475G) garnered an average of 1.28 seconds (Fast) for all the three-testing conducted.

In sum, it has been identified that the laptop (Acer Aspire E6 - 475G) is the fastest to accomplish the accessibility among other gadgets used while testing the speed.

Implication

As to the results presented above, it was proven that the laptop with the specified model and brand Acer Aspire E6 - 475G appeared to be the fastest gadget to carry out the process of accessing the thesis/capstone projects page of the web-based system. According to Sweet (2022), the fast speed performance of laptops to browse, access, and download files from the web-based system compared to other gadgets is mainly because of its hardware component. Specifically, it is Random Access Memory (RAM). RAM, the laptop's memory, and the processor affect how fast a laptop runs. The higher the number for each, the faster the speed.

For instance, *4*GB of RAM runs faster than 2 GB. The processor speed is measured in gigahertz, and a 2 GHz machine runs faster than a *1* GHz. Some processors have more than one "core" -- dual or quad, for instance -- which also typically adds speed. Thus, upgrading these laptop elements is essential to experience faster online and offline loading times. Also, she added that other components such as Central Processing Unit (CPU), Cache, Bus Speed, Hard Drive, Video Card, Latest Operating System, and Software affect the speed performance of the laptop in connecting to the internet and its ability to access the different websites or web-based system (Sweet, 2022).

Table 6. Testing the Speed and Accessibility of the Web-Based in terms of Downloading the Thesis/Capstone Projects from the Web-Based System Using Google Chrome as the Search Engine

GADGETS	T1	T2	Т3	AVERAGE
Tablet (Samsung Galaxy Tab A <i>8</i>)	3.62s	2.30s	2.44s	2.79s
Cellphone (Oppo A <i>9 2020</i>)	3.97s	4.40s	5.44s	4.60s
Laptop (Acer Aspire E <i>5</i> – <i>4</i> 75G)	3.46s	2. 84s	9.46s	5.25s
AVERAGE		4	21s	

Legend: 0.81s – 1.02s (Very Fast), 1.28s – 1.91s (Fast), 2.13s – 2.79s (Moderately Fast), 3.35s – 4.02s (Slow), 4.60s – 5.25s (Very Slow)

Concerning downloading files, i.e., thesis/capstone projects of the STEM alums from the web-based system, Table 4.6 presents the overall average of 4.21, implying a **very slow speed and accessibility**. Notably, the tablet (Samsung Galaxy Tab A8) yielded an average of 2.79 seconds (Moderately Fast); the cellphone yielded an average of 4.60 seconds (Very Slow), and the laptop yielded an average of 5.25 seconds (Very Slow) after the researchers conducted the three (3) testing.

In summary, the tablet (Samsung Galaxy Tab A8) was identified as the gadget that could download thesis/capstone project files from the web-based system quickly.

Implication

The testing results indicated that the Samsung Galaxy Tab A8 model tablet appeared to be quickest in completing the requested action of downloading the thesis/capstone files from the web-based system. Hence, these findings contradict the findings of a *2013* study conducted by Compuware APM (2013), a web optimization company. According to them, tablet owners are dissatisfied with their gadgets' web browsing and downloading capabilities because sites do not load as quickly as expected and are too slow to download files.

The study, commissioned by Compuware APM and conducted by Equation Research (2013), was based on *2,033* interviews conducted between January *5* and *16, 2013*. It targeted individuals who owned a tablet and had used it to browse the Internet and download files from the website within the previous six months. Compuware ARM asserts that the global survey results can be extrapolated with *95* percent precision to the rest of the world. The *15*-page report is a great read, as it contains numerous interesting tidbits, such as the following: *41%* of tablet users have encountered slow downloads of files, slow load times, page crashes, improper page formatting, and other problems. Seventy percent (*70%*) of tablet users expect websites to load and download files as quickly as desktop computers, if not faster. Thirty-four percent (*34*) of tablet users who attempted to access a website on their device encountered a *404* error. Indeed, the study contains many statistics, but two significant patterns stand out: Users already expect

tablets to provide at least the same level of performance as desktop computers, which has companies still in a state of astonishment.

Evaluation of the Web-Based System in terms of Functionality, Reliability, Usability, Efficiency, Maintainability, and Portability from the Perspective of the Users

This study had undergone evaluations from the chosen respondents, i.e., STEM students as users of the web-based system, to validate its Functionality, Reliability, Usability, Efficiency, Maintainability, and Portability. The evaluation was made possible through Google Forms, which took place on March *10-20, 2023*. Using the Weighted Mean, the following results were yielded.

INDICATORS	WEIGHTED MEAN	DESCRIPTION
Suitability – the user/s of the system can use it to find references for their thesis or capstone.	4.65	Very Highly Functional
Accurateness – the system can show precise thesis information and the details of STEM alums.	4.62	Very Highly Functional
Security – solely STEM students and the admin/s are competent to acquire.	4.39	Very Highly Functional
OVERALL MEAN	4.55	Very Highly Functional

 Table 7. Evaluation of the Web-Based System in terms of Functionality

Legend: 1.00-1.80 (Not Functional), 1.81-2.60 (Marginally Functional), 2.61-3.40 (Fairly Functional), 3.41-4.20 (Highly Functional), 4.21-5.00 (Very Highly Functional)

As evaluated by the STEM student respondents, the functionality of the web-based system is **very highly functional**, as evidenced by the mean of *4.55* (x=4.55). This means that concerning the suitability, the user/s of the system can use it to find references for their thesis or capstone (x=4.65); in terms of accurateness, the system can show precise thesis information as well as the details of STEM alums (x=4.62), and in terms of security, solely STEM students and the admin/s are competent to acquire (x=4.39).

In sum, the student users evaluated the functionality of the web-based system to be very highly functional.

Implication

The evaluation results mean that the developed web-based system functions very well since it suits the needs of the student users by providing them the reference once they find sources of their thesis or capstone projects. Also, since the admins of the web-based system are the research teachers, it

guarantees the users the veracity of information about the thesis or capstone. Similarly, the web-based system secures its data from being stolen by other students since only STEM students can access it since they are the ones only given the generated accounts to log in by the admin.

These results are supported by Lvivity (2018), who stated that if a person gets all of his data from desktop apps, it is likely spread out among different databases. This may not seem like a big deal, but it could slow down if his software has to ask for data from more than one source at runtime. Also, if his data sets are accessed and changed from different devices, the differences in their operating systems could cause errors and messed up data. These problems are solved by web-based systems, which store all user data in the cloud on a powerful server that can manage a person's information and quickly send it to software users when needed. Servers are also more reliable than individual hard drives, so if the user uses a web-based system, his data is less likely to be lost if his hard drive fails.

Also, the security of the web-based system is ensured since it is run on dedicated servers, which professional web administrators constantly moderate. Any possible errors or intrusions will be noticed and addressed quickly. As a result, a web-based system is much more secure than its desktop analog (Lvivity, 2018).

INDICATORS	WEIGHTED MEAN	DESCRIPTION
Maturity – The system functions as expected at the first contrivance and testing of the user/s.	4.39	Very Highly Reliable
Fault Tolerance – The system can recognize inappropriate data.	4.15	Highly Reliable
Recoverability – The system can retrieve forgotten usernames and passwords.	4.19	Highly Reliable
OVERALL MEAN	4.24	Very Highly Reliable

 Table 8. Evaluation of the Web-Based System in terms of Reliability

Legend: 1.00-1.80 (Unreliable), 1.81-2.60 (Marginally Reliable), 2.61-3.40 (Fairly Reliable), 3.41-4.20 (Highly Reliable), 4.21-5.00 (Very Highly Reliable)

Table 8 depicts the results of the reliability evaluation made by the users regarding the developed web-based system. It is indicated that the web-based system is **very highly reliable**, with a mean of 4.24 (x=4.24). This implies that in terms of maturity, the system is functioning as expected at the first contrivance and testing of the user/s (x=4.39). In terms of fault tolerance, the system can recognize inappropriate data (x=4.15), while with respect to recoverability, the system can retrieve forgotten usernames and passwords (x=4.19).

In sum, the users evaluated the reliability of the developed web-based system to be very highly reliable.

Implication

The results merely suggest that the developed web-based system functions how the users expected it to. Also, the web-based system detects inappropriate data encoded, requiring the admin to facilitate data encoding. Similarly, the web-based system can retrieve usernames and passwords once forgotten by the users. Indeed, this is confirmed by Adlava (2018), who claimed that a web-based system is the first point of access to the users, and in this sense, the web-based system should provide an excellent first impression by being reliable. Users do not notice when the web-based system is sound, but they indeed recognize when it is terrible. If the web-based system is frequently down, hacked, or less than user-friendly, the users will likely feel the system is unreliable. While there is always the possibility that a web-based system may crash, it is far less likely with a good admin, as they are consistently backing up data or cloning web-based systems in order to provide a quick solution to getting the system back online. Cheap administration often leads to a laggy web-based system, frustrating typical end-users. While there is never a guarantee that the web-based system will have no issues, good administration provides better user care and faster, more reliable, efficient web speeds with better security.

INDICATORS	WEIGHTED MEAN	DESCRIPTION
Understandability – The system feature buttons are well-labeled for the users to have a clearer and better understanding.	4.38	Very Highly Usable
Learnability – The system has a user-friendly interface where users can immediately learn from the system.	4.52	Very Highly Usable
Operability- The system can operate at full capacity.	4.33	Very Highly Usable
Attractiveness- The system has an extremely unique and appealing design.	4.67	Very Highly Usable
OVERALL MEAN	4.48	Very Highly Usable

 Table 9. Evaluation of the Web-Based System in terms of Usability

Legend: 1.00-1.80 (Unusable), 1.81-2.60 (Marginally Usable), 2.61-3.40 (Fairly Usable), 3.41-4.20 (Highly Usable), 4.21-5.00 (Very Highly Usable)

From the table on the preceding page, it could be gleaned that the student users evaluated the usability of the developed web-based system to be **very highly usable**, as shown by the overall mean of *4.48* (x=4.48). This implies that in the aspect of understandability, the system feature buttons are well-labeled for the users to have a clear and better understanding (x=4.38). In the aspect of learnability, the system has a user-friendly interface where users can immediately learn from the system (x=4.52), while in

operability, the system can operate at full capacity (x=4.33). Also, for attractiveness, the system has an extremely unique and appealing design (x=4.67).

In summary, the student users evaluated the developed web-based system to be very highly usable.

Implications

The results imply that the web-based system, with respect to its usability, has understandable commands and menu options that allow the users to easily learn the system's directions, making it a userfriendly web-based system. Also, concerning its operation, the web-based system has a fully operational system. Furthermore, the unique and appealing visual layout using the astronomy theme makes the webbased system attractive to users. According to Elberkawi, EL-firjani, Maatuk, and Aljawarneh (2020), usability is one of the essential elements to make a product usable. Web-based system evaluation determines the quality of the web-based application. Usability testing helps discover mistakes the users commit when interacting with the system's interfaces. The selection of users representing the entire population in accomplishing given testing tasks is needed. A target user population should be selected and recruited during a usability test. The test set can be done through usability laboratory experiments or in a workplace. The web-based usability testing can also be used as a remote usability test where the user and experimenter might be located remotely.

Moreover, the learnability in the usability of a web-based system is essential to consider because some security systems are not used, unfortunately, just due to the difficulty implicated in the system and the extreme security constraints for task completion (Yee, 2014). Further, Yee added that designers should provide an easy-to-use and easy-to-understand interface, less complex because the average web user probably has limited or no understanding of the technical material and hence the designer needs to provide support for a better understanding of warning messages, wizards (if any) and other interacting tools, etc. It is highly recommended that designers consider security measures in the early stages of software development to get an optimized, usable, and secure design.

INDICATORS	WEIGHTED MEAN	DESCRIPTION
Time Behavior - The system responds expeditiously to every deed the user/s implied.	4.65	Very Highly Efficient
Resource Utilization- The system employs a database that gathers the thesis and capstone projects of previous and current STEM students.	4.56	Very Highly Efficient
OVERALL MEAN	4.61	Very Highly Efficient

 Table 10. Evaluation of the Web-Based System in terms of Efficiency

Legend: 1.00-1.80 (Inefficient), 1.81-2.60 (Marginally Efficient), 2.61-3.40 (Fairly Efficient), 3.41-4.20 (Highly Efficient), 4.21-5.00 (Very Highly Efficient)

It can be construed from the above table that the users evaluated the web-based system to be **very highly efficient**, as demonstrated by the mean of 4.61 (x=4.61). This expressly signifies that for time behavior, the system responds expeditiously to every deed the user/s implied (x=4.65). With respect to resource utilization, the system employs a database that gathers the thesis and capstone projects of previous and current STEM students (x=4.56).

Indeed, the users evaluated the efficiency of the developed web-based system to be very highly efficient.

Implication

The results imply that the developed web-based system responds immediately to the users' actions. It also stores the previous and current outputs of the STEM students because of its database, making it readily available for the STEM student users to access, view, and download for their reference. According to Dray (2022), efficiency measures how well a web-based system does what it should do. Assuming that the utility and effectiveness goals are fulfilled, efficiency is the next usability goal. However, it goes further than that. A system needs to do more than allow users to use it; it needs to support the users. When using tools on a web-based system, the users should feel that the system is coherent, compact, sequential, and logical.

Additionally, Ahmed (2011) averred that efficiency could be defined as a measure of how much effort is required to achieve a required outcome or make the best use of the available resources. Resource utilization is the percentage of time a component is occupied compared with the total time the component is available for use. For example, if a CPU processes transactions for a total of *40* seconds during a single minute, its utilization during that interval is *67* percent. A resource is considered critical to performance when it becomes overused or its utilization is disproportionate to other components.

INDICATORS	WEIGHTED MEAN	DESCRIPTION
Analyzability - Anyone with administrator permission can easily analyze the system.	4.42	Very Highly Maintainable
Changeability – The system can be developed by the developers in the near future.	4.51	Very Highly Maintainable
Stability – Long-term stability maintained in the system time frame.	4.38	Very Highly Maintainable
Testability – The system undergoes a lot of trials to ensure its effectiveness.	4.43	Very Highly Maintainable
OVERALL MEAN	4.44	Very Highly Maintainable

Table 11. Evaluation of the Web-Based System in terms of Maintainability

Legend: 1.00-1.80 (Unmaintainable), 1.81-2.60 (Marginally Maintainable), 2.61-3.40 (Fairly Maintainable), 3.41-4.20 (Highly Maintainable), 4.21-5.00 (Very Highly Maintainable)

From the table above, it could be understood that the student users evaluated the developed webbased system to be **very highly maintainable**, as shown by the overall mean of *4.44* (x=4.44). This indicates that in its analyzability aspect, anyone with permission from the administrator can easily analyze the system (x=4.42). In its changeability aspect, the system can be developed by the developers in the near future (x=4.51). Also, in its stability aspect, long-term stability is maintained in the system time frame (x=4.38), and lastly, in its testability aspect, the system undergoes a lot of trials to ensure its effectiveness (x=4.43).

Indeed, the student users evaluated the developed web-based system to be very highly maintainable.

Implication

The results show that web-based system maintainability is one of the most critical quality attributes. To increase the quality of a web-based system, manage it more efficiently, and decrease its cost, maintainability should be considered. Since according to Nabil, Mosad, and Hefny (2011), maintainability addresses how much a web-based system can be easily modified during its life. It includes any corrective, adaptive, perfective, and preventive activities made to the application during its operational phase to meet or improve specific requirements. It respectively considered an important quality factor for the developer.

Furthermore, Seref and Tanriover (2016) asserted that every web-based system needs to be modified to meet users' requirements and new technologies. Adding and deleting codes and adopting the system to a new operational platform are examples of modification operations. ISO/IEC *9126* defines web-based system maintainability as "the capability of the web-based system product to be modified." Another

definition for web-based system maintainability is "the ease with which a web-based system or component can be modified to correct faults, improve performance or other attributes, or adapt to a changed environment."

On the other hand, maintainability also depends on the extent of use of web-based system constructs or patterns, programming paradigms/languages, application frameworks, developers' programming skills, coding rules, design patterns, etc. It has been observed that maintenance effort in the web-based system life cycle ranges from 65% to 75% of the total web-based system development time. Also, a web-based system's maintainability feature increases its quality. With a maintainable web-based system, it is easy to modify parts of the system, meet user requirements in a shorter time and manage the web-based system efficiently (Seref & Tanriover, 2016).

INDICATORS	WEIGHTED MEAN	DESCRIPTION
Adaptability – The system can adjust the graphical user interface for screen resolution.	4.32	Very Highly Portable
Install Ability – The installer for the system is crate and provided by the creators.	4.42	Very Highly Portable
Conformance – The system can efficiently provide the user/s queries according to its capabilities.	4.40	Very Highly Portable
Replace Ability – Updates can be constructed to the system	4.39	Very Highly Portable
OVERALL MEAN	4.38	Very Highly Portable

 Table 12. Evaluation of the Web-Based System in terms of Portability

Legend: 1.00-1.80 (Unportable), 1.81-2.60 (Marginally Portable), 2.61-3.40 (Fairly Portable), 3.41-4.20 (Highly Portable), 4.21-5.00 (Very Highly Portable)

Table 12 reveals the evaluation of the student users regarding the developed web-based system. They evaluated the web-based system to be **very highly portable**, as demonstrated by the mean of 4.38 (x=4.38). This certainly means that in terms of its adaptability, the system can adjust the graphical user interface for any screen resolution (x=4.32). Regarding its install ability, the installer for the system is crate and provided by the creators (x=4.42). Concerning conformance, the system can efficiently provide the user/s queries according to its capabilities (x=4.40), and concerning its replacement ability, updates can be constructed to the system (x=4.39).

In sum, the student users evaluated the web-based system to be very highly portable.

Implication

The results imply that portability is an essential characteristic that presents the strategy of building a web-based system to run on a specific environment or hardware configuration. At the same time, it can be refined with minimum effort to run another environment or hardware configurations. Therefore, it was decided to include portability as a quality factor from the developer's perspective (Nabil, Mosad, & Hefny, 2011). Moreover, web-based system portability is the possibility of using the same web-based system in different environments. It applies to the system available for two or more different platforms or recompiled for them.

Portability is a characteristic attributed to a computer program if it can run with minimal rework on operating systems (OSes) other than the one for which it was created. Web-based system portability is essential for applications, as working on other desktop and mobile platforms increases user flexibility and the application's potential user base. Building a web-based system with portability in mind can save developers time and overhead when moving new software across an environment (Gillis, 2022). Portability means portable data can be moved from one database or repository to another (DX Heroes, 2022).

Evaluation of the Web-Based System in terms of Functionality, Reliability, Usability, Efficiency, Maintainability, and Portability from the Perspective of the Administrators

This study had undergone evaluations from the chosen respondents, i.e., fourth-year students as IT experts from Mindanao State University, General Santos City, and selected teachers in the STEM strand as administrators of the web-based system to validate its Functionality, Reliability, Usability, Efficiency, Maintainability, and Portability. The evaluation happened last March *10-20, 2023*. Using the Weighted Mean, the following results were yielded.

INDICATORS	WEIGHTED MEAN	DESCRIPTION
Suitability – The system administrator can use it to view the thesis and capstone project and students' information of previous and current STEM students.	4.92	Very Highly Functional
Accuracy – The management system can show precise thesis and capstone project information and detailed profile information of previous and current STEM students.	4.68	Very Highly Functional
Security – The administrator can only access the management system.	4.60	Very Highly Functional
OVERALL MEAN	4.73	Very Highly Functional

Table 13. Evaluation of the Web-Based System in terms of Functionality

Legend: 1.00-1.80 (Not Functional), 1.81-2.60 (Marginally Functional), 2.61-3.40 (Fairly Functional), 3.41-4.20 (Highly Functional), 4.21-5.00 (Very Highly Functional)

As evaluated by the IT experts and selected STEM teacher respondents, the functionality of the web-based system is **very highly functional**, as evidenced by the mean of 4.73 (x=4.73). This means that concerning suitability, the system administrator can use it to view the thesis and capstone projects and students information of previous and current STEM students. (x=4.92); in terms of accuracy, the management system can show precise thesis and capstone project information and detailed profile information of previous and current STEM students. (x=4.68), Moreover, regarding security, the administrator can only access the management system. (x=4.60).

In sum, the IT experts and selected STEM teacher administrators evaluated the functionality of the web-based system to be very highly functional.

Implication

The evaluation results mean that the developed web-based system functions very well since it suits the needs of the administrators by allowing them to view the thesis and capstone project and students' information of previous and current STEM students. Also, since the admins of the web-based system are the research teachers, it guarantees the users the veracity of information about the thesis or capstone and the students' profile information. Similarly, the web-based system secures its data since only the admin can access the management system.

These findings are supported by Lvivity (2018), who stated that if an individual obtains all of his data from desktop applications, it is likely stored in multiple databases. This may not seem like a significant issue, but if his software must request data from multiple sources at runtime, its performance may suffer.

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Moreover, if his data sets are accessed and modified from different devices, the differences in their operating systems may result in errors and corrupted information. These issues are resolved by web-based systems, which store all user data in the cloud on a powerful server that can efficiently manage a person's data and send it to software users as needed. Additionally, servers are more dependable than individual hard drives, so if a user utilizes a web-based system, it is less likely that his data will be lost if his hard drive fails.

In addition, the web-based system's security is ensured by the fact that it is hosted on dedicated servers that expert web administrators constantly monitor. Any potential errors or intrusions will be quickly identified and resolved. Thus, a web-based system is significantly more secure than its desktop equivalent (Lvivity, 2018).

INDICATORS	WEIGHTED MEAN	DESCRIPTION
Maturity – At the first contrivance and testing of the administrator, the system functions as expected.	4.64	Very Highly Reliable
Fault tolerance – The system can recognize inappropriate data.	4.64	Highly Reliable
Recoverability – The system can retrieve forgotten usernames and passwords.	4.60	Highly Reliable
OVERALL MEAN	4.63	Very Highly Reliable

Table 14 Evaluation of the Web-Based System in terms of Reliability

Legend: 1.00-1.80 (Unreliable), 1.81-2.60 (Marginally Reliable), 2.61-3.40 (Fairly Reliable), 3.41-4.20 (Highly Reliable), 4.21-5.00 (Very Highly Reliable)

Table 14 depicts the results of the reliability evaluation made by the administrators regarding the developed web-based system. It is shown that the web-based system is **very highly reliable**, with a mean of 4.63 (x=4.63). This infers that in terms of maturity, at the first contrivance and testing of the administrator, the system is functioning as expected (x=4.64). In terms of fault tolerance, the system can recognize inappropriate data (x=4.64), while with respect to recoverability, the system can retrieve forgotten usernames and passwords (x=4.60).

In sum, the administrators evaluated the reliability of the developed web-based system to be very highly reliable.

Implication

The results indicate that the developed web-based system functions as the administrator anticipated. In addition, the web-based system detects improperly encoded data, necessitating that the

administrator assists with data encoding issues. Similarly, the web-based system can retrieve user names and passwords that have been forgotten. Adlava (2018) confirms this by stating that a web-based system is the first point of access for users, and in this regard, the web-based system should provide a positive first impression by being trustworthy. Users do not notice when a web-based system is effective, but they do notice when it is ineffective. If the web-based system is frequently unavailable, hacked, or challenging to use, users will likely view it as unreliable. There is always a chance that a web-based system will crash, but it is much less likely if you have a good administrator who consistently backs up data and clones webbased systems to provide a quick solution for bringing the system back online. Cheap administration frequently results in a sluggish web-based system, significantly annoying end-users. While there is never a guarantee that a web-based system will be problem-free, good administration provides better user care and faster, more reliable, and more secure web speeds.

INDICATORS	WEIGHTED MEAN	DESCRIPTION
Understandability – The management system features well-labeled buttons for the administrator to have a clear and better understanding.	4.84	Very Highly Usable
Learnability – The management system has a user-friendly interface where the administrator can immediately learn the system.	4.92	Very Highly Usable
Operability -The management system can operate at full capacity.	4.52	Very Highly Usable
Attractiveness - The management system has an extremely unique and appealing design.	4.24	Very Highly Usable
OVERALL MEAN	4.63	Very Highly Usable

 Table 15. Evaluation of the Web-Based System in terms of Usability

Legend: 1.00-1.80 (Unusable), 1.81-2.60 (Marginally Usable), 2.61-3.40 (Fairly Usable), 3.41-4.20 (Highly Usable), 4.21-5.00 (Very Highly Usable)

From the table above, it could be construed that the administrators evaluated the usability of the developed web-based system to be **very highly usable**, as shown by the overall mean of 4.63 (x=4.63). This specifically implies that in the aspect of understandability, the management system features well-labeled buttons for the administrator to have a clear and better understanding (x=4.84). Regarding learnability, the management system has a user-friendly interface where the administrator can immediately learn the system. (x=4.92), while in operability, the management system can operate at full capacity

(x=4.52). Also, concerning attractiveness, the system has an extremely unique and appealing design (x=4.24).

In summary, the administrators evaluated the developed web-based system to be very highly usable.

Implications

The results indicate that the web-based system is user-friendly in terms of its usability because its commands and menu options are straightforward and allow the administrator to quickly learn the system's instructions, making it a user-friendly web-based system. Regarding its operation, the web-based system is fully functional. In addition, the user-friendliness of the web-based system is enhanced by its distinct and appealing visual design, which is based on an astronomy motif.

According to Elberkawi, EL-firjani, Maatuk, and Aljawarneh (2020), usability is one of the key factors contributing to a product's usability. Web-based system evaluation is the process of determining the application's quality. Usability testing aids in identifying errors made by users while interacting with a system's interfaces. Selecting users who accurately represent the entire user population when performing specific testing tasks is necessary. A target user population should be selected and recruited during a usability test. The testing environment may consist of usability laboratory experiments or the actual workplace. The web-based usability testing can also be utilized as a remote usability test, in which the user and experimenter are physically separated.

Furthermore, it is essential to consider the learnability of a web-based system's usability because some security systems are unfortunately not used due to the complexity of the system and the extreme security constraints for task completion (Yee, 2014). Yee added that designers should provide a simple, user-friendly interface because the average web user likely has a limited or nonexistent understanding of technical material. Therefore, the designer must provide support to understand warning messages better, wizards (if any), and other interactive tools. In order to create an optimized, usable, and secure design, it is strongly advised that designers take security measures into account during the early phases of software development.

INDICATORS	WEIGHTED MEAN	DESCRIPTION
Time Behavior - The management system responds expeditiously to every deed the administrator implies.	4.36	Very Highly Efficient
Resource Utilization - The management system employs a database that gathers thesis and capstone projects and students' information on previous and current STEM students.	4.72	Very Highly Efficient
OVERALL MEAN	4.54	Very Highly Efficient

 Table 16. Evaluation of the Web-Based System in terms of Efficiency

Legend: 1.00-1.80 (Inefficient), 1.81-2.60 (Marginally Efficient), 2.61-3.40 (Fairly Efficient), 3.41-4.20 (Highly Efficient), 4.21-5.00 (Very Highly Efficient)

It can be interpreted from the above table that the administrators evaluated the web-based system to be **very highly efficient**, as demonstrated by the mean of 4.54 (x=4.54). This suggests explicitly that concerning time behavior, the management system responds expeditiously to every deed that the administrator implied (x=4.36). In contrast, the management system employs a database for resource utilization that gathers thesis and capstone projects and students' information on previous and current STEM students (x=4.72).

Indeed, the administrators evaluated the efficiency of the developed web-based system to be very highly efficient.

Implication

The results indicate that the developed web-based system responds immediately and productively to administrator input. Its database also stores the previous and current profile information and outputs of STEM students, making it readily available for STEM student users to access, view, and download for reference purposes. According to Dray (2022), the efficiency of a web-based system is a measurement of how well it performs its intended functions. Assuming that the utility and effectiveness objectives are met, the next usability goal is efficiency. Nevertheless, it goes beyond that. A system must do more than permit users to utilize it; it must also support users. Users of a web-based system should feel that the system is coherent, compact, sequential, and logical when using its tools.

In addition, Ahmed (2011) also asserted that efficiency is a measurement of the effort required to achieve a desired outcome or make the most of available resources. Resource utilization refers to the proportion of a component's available time that it is being utilized. For instance, if a CPU processes transactions for a total of *40* seconds in a minute, its utilization during that interval is *67%*. A resource is deemed crucial to performance when its utilization is excessive or disproportionate to other components.

Ahmed (2011) also suggested that an efficient web-based system is user-friendly, which means the application, equipment, facility, process, or system is compatible with its intended user's ability to use it easily and successfully. It should be helpful, too, meaning a web-based system's content must benefit users. The web-based system also must have an easier way for users to get the product or services. Also, it should be suitable. The web-based system must be suitable to open and read by any user it is intended for, and lastly, attractive. The web-based system must be attractive to the users by making its content more attractive with signposts using graphics that reflect its intended purpose and offerings.

 Table 17. Evaluation of the Web-Based System in terms of Maintainability

INDICATORS	WEIGHTED MEAN	DESCRIPTION
Analyzability - Anyone with administrator permission can	4.56	Very Highly Maintainable
easily analyze the system.		
Changeability – The system can		
be developed by the developers	4.76	Very Highly Maintainable
in the near future.		
Stability – The system can be		
maintained in a long-term time	4.76	Very Highly Maintainable
frame.		
Testability – The system		
undergoes a lot of trials to ensure	4.56	Very Highly Maintainable
its effectiveness.		
OVERALL MEAN	4.66	Very Highly Maintainable

Legend: 1.00-1.80 (Unmaintainable), 1.81-2.60 (Marginally Maintainable), 2.61-3.40 (Fairly Maintainable), 3.41-4.20 (Highly Maintainable), 4.21-5.00 (Very Highly Maintainable)

From Table 17, it could be understood that the administrators evaluated the developed web-based system to be **very highly maintainable**, as shown by the overall mean of 4.66 (x=4.66). This indicates that in its analyzability aspect, anyone with permission from the administrator can easily analyze the system (x=4.56). In its changeability aspect, the system can be developed by the developers in the near future (x=4.76). Also, in its stability aspect, the system can be maintained long-term (x=4.76). Lastly, in its testability aspect, the system undergoes a lot of trials to ensure its effectiveness (x=4.56).

Indeed, the administrators evaluated the developed web-based system to be very highly maintainable.

Implication

The results indicate that maintainability is one of the essential quality attributes for web-based systems. Maintainability should be considered to improve the quality of a web-based system, manage it more effectively, and reduce its overall cost. According to Nabil, Mosad, and Hefny (2011), maintainability refers to the ease with which a web-based system can be modified throughout its lifetime. It consists of

any corrective, adaptive, perfective, and preventive activities performed on an application during its operational phase to meet or exceed specific requirements. It was considered a significant quality factor by the developer.

Moreover, Seref and Tanriover (2016) argued that every web-based system must be modified to accommodate users' needs and introduce new technologies. Modification operations include adding and deleting codes and migrating the system to a new operational platform. Maintainability is defined by ISO/IEC *9126* as "the capability of the web-based system product to be modified." A second definition of web-based system maintainability is "the ease with which a web-based system or component can be modified to correct faults, improve performance or other attributes, or adapt to a changed environment."

The which extent to web-based system constructs or patterns, programming paradigms/languages, application frameworks, developer programming skills, coding rules, design patterns, etc., are utilized also impacts maintainability. It has been observed that maintenance effort in the life cycle of a web-based system ranges between 65 and 75 percent of the total web-based system development time. Additionally, the quality of a web-based system is enhanced by its maintainability. With a maintainable web-based system, it is simple to modify system components, meet user needs in less time, and efficiently manage the web-based system (Seref & Tanriover, 2016).

INDICATORS	WEIGHTED MEAN	DESCRIPTION
Adaptability – The system can adjust the graphical user interface for screen resolution.	4.92	Very Highly Portable
Install Ability – The installer for the system is crate and provided by the creators.	4.64	Very Highly Portable
Conformance – The system can efficiently provide the user/s queries according to its capabilities.	4.68	Very Highly Portable
Replace Ability – Updates can be constructed to the system.	4.80	Very Highly Portable
OVERALL MEAN	4.76	Very Highly Portable

 Table 18. Evaluation of the Web-Based System in terms of Portability

Legend: 1.00-1.80 (Unportable), 1.81-2.60 (Marginally Portable), 2.61-3.40 (Fairly Portable), 3.41-4.20 (Highly Portable), 4.21-5.00 (Very Highly Portable)

Table *18* reveals the evaluation of the administrators regarding the developed web-based system. They evaluated the web-based system to be **very highly portable**, as demonstrated by the mean of *4.76* (x=4.76). This certainly means that in terms of its adaptability, the system can adjust the graphical user interface for any screen resolution (x=4.92). Regarding its install ability, the installer for the system is crate

and provided by the creators (x=4.64). Concerning conformance, the system can efficiently provide the user/s queries according to its capabilities (x=4.68), and concerning its replacement ability, updates can be constructed to the system (x=4.80).

In sum, the administrators evaluated the web-based system to be very highly portable.

Implication

The results show that portability is also an important feature. This is the strategy of building a webbased system to run on a specific environment or hardware configuration. However, it can be tweaked to run on another environment or hardware configuration with minimal effort. Because of this, portability was chosen as a quality factor from the developer's point of view (Nabil, Mosad, & Hefny, 2011). Also, the portability of a web-based system means that the same web-based system can be used in different environments. It applies to systems available on or can be recompiled for two or more platforms.

Portability is a trait of a computer program that means it can run on operating systems (OSes) other than the one it was made for with minimal changes. Web-based system portability is essential for applications because working on different desktop and mobile platforms gives users more freedom and increases the number of people using the application. When moving new software from one environment to another, developers can save time and money by building a web-based system with portability in mind (Gillis, 2022).

Also, data that can be moved from one database or repository to another is said to be portable. It means the data are stored in easy-to-access electronic files instead of being shown on a screen. If not, the data would have to be retyped word for word into another program, and each image on the screen would have to be taken separately (DX Heroes, 2022).

SUMMARY OF FINDINGS

To remedy the pressing struggles that STEM students encountered in seeking thesis and capstone project references, the researchers developed using an adopted but modified protocol, the STEM Web-Based System for Student Profiling and Archiving of Thesis and Capstone Projects. It was successfully developed by utilizing equipment such as a laptop, desktop, various accessories, and the necessary system applications, such as Visual Studio Code and XAMPP. Then, the researchers opened Visual Studio Code and edited the various codes in each programming language. The codes were modified by the selected topic, astronomy. Next, the researchers created the user interface using HTML, CSS, and JavaScript. MySQL and phpMyAdmin were used for the backend.

Further, to ensure the speed and accessibility, and overall functions of the developed web-based system, the researchers subjected the web-based system to a series of trial testing that proved its intended functions and capabilities. Concerning the web-based system's speed and accessibility, using Google as

the search engine, it was found that in terms of searching the web-based system, an overall average of *1.38*s, signifying **fast speed and accessibility** was recorded. Among the three gadgets used during the testing, the tablet (Samsung Galaxy Tab A8) yielded the fastest in searching.

Also, for logging in to the web-based system, Samsung Galaxy Tab A8 yielded the fastest response despite an average speed and accessibility of all gadgets, which is *3.04* seconds, indicating a **slow speed and accessibility** performance. However, this slow speed and accessibility indication is not the ultimate evidence to generally conclude the developed web-based system's ability, considering the location where the testing was conducted as part of this study's limitation. Additionally, regarding accessing the profile page, the average result demonstrated by the gadgets used is *1.53* seconds. indicating **fast speed and accessibility**. The cellphone (Oppo A9 *2020*) showed the fastest response ... this testing.

Moreover, upon accessing the web-based system's gallery from different gadgets, entirely, the three (3) gadgets generated an overall average of 1.39 seconds, signifying **fast speed and accessibility**, and the cellphone (Oppo A9 2020) was identified as the fastest gadget to access the gallery of the web-based system. Regarding launching the thesis/capstone projects section in the web-based system, the three (3) gadgets used in testing yielded an overall average of 1.58 seconds, indicating **fast speed and accessibility**. It has been identified that the laptop (Acer Aspire E6 – 475G) is the fastest to accomplish accessibility among other gadgets used. Lastly, to downloading files, i.e., thesis/capstone projects of the STEM alums from the web-based system, the overall average of 4.21 was indicated, implying a **very slow speed and accessibility**. However, among the gadgets used in downloading, the tablet (Samsung Galaxy Tab A8) exemplified the fastest response to the command.

Subsequently, the researchers subjected the developed web-based system to the evaluation of the selected respondents. From the perspective of the student users, it was revealed that the web-based system is **very highly functional**, **very highly reliable**, **very highly usable**, **very highly efficient**, **very highly maintainable**, and **very highly portable**, as evidenced by the overall mean of 4.55 (x=4.55), 4.24 (x=4.24), 4.48 (x=4.48), 4.61 (x=4.61), 4.44 (x=4.44), and 4.38 (x=4.38), respectively.

In the same way, from the perspective of administrators, they evaluated the web-based system to be **very highly functional**, **very highly reliable**, **very highly usable**, **very highly efficient**, **very highly maintainable**, and **very highly portable**, as demonstrated by the overall mean of 4.73 (x=4.73), 4.63 (x=4.63), 4.63 (x=4.63), 4.54 (x=4.54), 4.66 (x=4.66), and 4.76 (x=4.76), respectively.

CONCLUSIONS

Based on the findings, the researchers concluded that the STEM Web-Based System for Students' Profiling and Archiving of Thesis and Capstone Projects was developed using the adopted but modified protocol. During the series of testing and evaluation, it was revealed that the web-based system showed exceptional speed and accessibility. The three *(3)* gadgets used in the testing of speed and accessibility

vary significantly different. The tablet (Samsung Galaxy Tab A8) indicated the fastest response to the command of searching the web-based system, logging in to the web-based system, and downloading files, i.e., thesis and capstone projects from the web-based system. On the other hand, the cellphone (Oppo A9 2020) exemplified the fastest response to accessing the web-based system's user profile and gallery, while the laptop (Acer Aspire E6 – 475G) demonstrated the fastest response to the command of launching the thesis and capstone project page. Furthermore, the student users and the web-based system administrators evaluated the system to be highly functional, reliable, usable, efficient, maintainable, and portable.

RECOMMENDATIONS

With the findings and the conclusions, the researchers do hereby recommend the following:

- The researchers used a Globe Telco WIFI modem as the internet provider during the testing. Thus, future researchers may use other internet providers, i.e., other telecommunications, for comparative analysis of the results concerning the speed and accessibility of the web-based system.
- 2. The researchers used the following brands of gadgets during the testing: Samsung Galaxy Tab A8, Oppo A9 2020, and Acer Aspire E5-457G. The researchers, therefore, recommend to future researchers that they may use other brands and specs of gadgets in the subsequent testing to determine the difference in speed and accessibility.
- Also, since the location where the testing was conducted forms part of this study's limitation, future researchers may find locations where internet connectivity's signal strength is remarkably faster for better speed and accessibility testing results.
- 4. Since the present researchers have used Wireless Fidelity (WIFI) as the internet connectivity provider during the testing, it is suggested that future researchers may try using mobile data in the following testing for comparative analysis of the results.
- 5. STEM strand head may assign a system administrator who can maintain and update the database every academic year. The administrator must be able to manually add all the profile information and the thesis and capstone projects of the STEM students of Colon National High School.
- 6. The system is web-based, so the main thing needed is a stable internet connection and the correct browsers to run. Using the panel, the users, administrators, and developers may have access to all the files inside the system. The database of the system is also uploaded on the web.
- A manual created by the researchers may be used by the administrator to guide him/her in using the STEM Web-Based System. The manual's contents include step-by-step procedures for properly managing and using the system.

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