DEVELOPMENT OF DOCTRACK: A WEB-BASED PRINTING SYSTEM

A Project Study

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DEDICATION

This research study is dedicated to our family whom we have a feeling of gratitude over. To our beloved friends who cheered and supported us in these troubled times. Our family and friends have been our constant inspiration throughout this research study. Without their continuous love and support, this research would not be possible in the first place.

We would also like to dedicate this research study to our research study adviser who helped us with this report. Their eagerness to assist and offer comments made doing this study a pleasurable experience. To our classmates who have been through this experience with us and to our professors at the Technological University of the Philippines.

Lastly, we would like to dedicate this research study to the future hard-working students who will undoubtedly make use of this study to their future needs.

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INTRODUCTION

Background of the Study

Paper printing plays a large part in the distribution of knowledge. For many years, it has made great contributions in the education market, making schools of all levels one of the major consumers of printing materials (Marketing, 2016).

Today, as the world continuously becomes more and more paperless, printing still proves to be essential as there are still a number of times when a student or a teacher would need printing. However, most printing services today have a high time cost and low efficiency. The printing machines itself are incapable of computing and analyzing an entire data and cost (Lu, 2019).

While this problem does not affect those who own printing machines at their home or offices, it is an inconvenience to the majority of those who cannot afford a printing machine. In most cases, students need to go to the library, computer lab and even computer shops outside the school premises. This has proven to be a great inconvenience as some students enjoy sleeping-in at the last minute. As a result, some are likely to encounter unavailable desktops (Kiosks, 2020).

Long queues also pose a problem to students. A study from COMSATS Institute of Information Technology, Abbottabad, Pakistan, show that more than 70% of the university's students are not happy and are dissatisfied with waiting lines as this is an inconvenience (Qureshi et al, 2013).

Considering the stated problems, a project study entitled Development of DocTrack: A Web-Based Printing App was proposed. This is an application that is capable of transferring document files to the printing server using a web browser and an internet. This will allow online payment through Gcash or Paymaya for a faster and precise transaction.

Objective of the Study

The general objective of the study is to develop a DocTrack: A Web-Based Printing App.

Specifically, the study aims to:

1. Design a Web-Based Printing App with the following characteristics:
    a. For clients-
        a. has a sign-up module for new users;
        b. order files to be printed;
        c. can upload/send PDF files;
        d. has a provision to select a time for pick up, type and size of paper, monochrome or colored print, and number of copies to be printed;
        e. can check the price before the confirmation of order;
        f. can pay transaction(s) via Gcash or Paymaya;
        g. receive an online receipt alongside order number as a document release code; and
        h. file uploaded are automatically removed after 24 hours.
    b. For admin-
        a. has a dashboard;

b. view the list of orders;
c. view order details;
d. manage the order's progress by confirming which orders are prepared, confirmed, rejected and completed;
e. can view orders by time of pickup, file name, order number, and time uploaded; and
f. automatically remove the received documents after 24 hours.

2. Create the web application using Visual Studio Code, MongoDB, ExpressJS, NodeJS and Bootstrap;
3. Test the functionality and effectiveness of the system by user testing; and
4. Use the ISO 25010 software equality evaluation to assess the acceptability of the prototype.

Scope and Limitations

The study involves the designing and the development of DocTrack: A Web-Based Printing App. The app will have two end users for the clients and the admin. For the admin-end, the app will allow the admin to easily manage the orders to be printed. The app will ensure the safety of the business by providing a Pay-to-Order only option. For the client-end, the app will provide an easier way for the end-user to transfer documents for printing. The app will provide a user login and an online receipt with order number as a release code to ensure that the documents are given to the proper customer. The application can be easily accessed in any device, anywhere, anytime with the use of a web browser and an internet.

Initially, the study focuses on Technological University of the Philippines, Manila campus and is limited only to their students, teachers and other personnel only. Furthermore, the application will not be accepting any files other than PDF files.

Significance of the Study

The development of the DocTrack app is important to provide a convenient and safe printing environment at Technological University of the Philippines, Manila. Specifically, this application aims to avoid overcrowding of customers. More importantly, the application will be beneficial to the following:

Customers. This application will be beneficial to the customers of a printing store for this will allow them to quickly print documents in any device, anywhere, anytime by using a web-browser and an internet.

Proprietor. This application will be beneficial to the printing business for this will ensure the security of the store by providing a Pay-to-Order only option. This will also improve customer service, attracting more potential customers.

Chapter 2

CONCEPTUAL FRAMEWORK

This chapter provides a review of the articles, journals, and studies that were used to support the study's framework. This aids in the research process and provides the necessary information about the materials to be used in developing the DocTrack app. It also covers the study's conceptual model and operational definitions of terms.

Review of Related Literature and Studies

Digital Printing

Today, printing has become more and more accessible to the general community, with some modern devices even enabling data publishing (MPII, 2021). However, while personal printing may satisfy for personal use, ones who support printing services to promote their businesses face a unique set of issues (MPII, 2021). In fact, generally 20% of the result of printing are not even collected, and 40% of the result of printing can print duplex or double-sided to significantly reduce a business's operational paper costs (TOPS, n.d.). For this reason, organizations everywhere are constantly looking for ways to save money and plan for the future. (BBC Digital, 2015).

Benefits of Digital Printing on School Campuses

According to Flesch (2021), there are 5 Ways Schools Can Benefit from Managed Print Services:

Cost Savings and Simplified Budgets. Budget constraints and greater regulation of line item expenditures are creating a difficulty for school systems. Planning committees and executives may correctly estimate print prices, reduce admin duties, and consolidate

their finances with managed print solutions, leading to a simpler application procedures. The service also aids in understanding exact necessities, hence reducing unnecessary expenses, flexion, and supply issues, all of which resulting in costly downtime.

Going Green. Conserving paper not just to save money, but it also decreases garbage and its ecological effects. Controlled print allows schools to upgrade to even more resource-efficient devices, arrange a recycling system for paper, toner, and old printers, and apply basic waste-reduction measures. Sustainable activities are ideally conducive for universities, as young people are generally conscious of environmental challenges such as global warming and renewable energy. They perform an important role in the implementation, conservation measures, and adopting to an ecologically beneficial behavior.

Greater Accessibility. Many colleges have a fleet of machines and hundreds of users distributed across several locations. Educators and administrators could use managed print to print documents from every location on the network. Logging in with credentials enables you to retrieve print jobs from any printer.

Enhanced Security. Keeping student records private is a big concern for administrators. With a fleet of shared printers, mitigating that risk can be difficult. By leaving documents on printer trays, you're giving yourself the chance to break compliance rules. Users can queue a print job until they may obtain it by authenticating the request using a PIN number or badge/card reader.

Free Up IT to Focus on Student Needs. Computers and other forms of technology are an important aspect of classroom instruction. Many school IT personnel are being pulled in several ways and are struggling to strike a balance between student equipment

demands and administrative office equipment demands. Troubleshooting printer difficulties, such as paper jams, toner demands, and network connection difficulties, consumes a significant portion of an IT department's time. If a classroom's computer or equipment problem is delayed due to time spent dealing with printing difficulties, it might detract from pupils' learning. When a managed print solution is deployed, when an issue emerges, notifications are sent to the provider, and measures are taken automatically to resolve the issue. As a consequence, there is less downtime and less demand on IT staff.

Web-to-Print Solution

The internet and technology have undeniably revolutionized the world and has made our lives easier. With the introduction of web-to-print and digital printing technology, this is especially evident in the printing world. Businesses are now offering digital stores in order to compete in the current eCommerce print industry. Customers can now order products online or even customize them based on their preferences. Without a doubt, web-to-print technology has become an exceptional solution for many potential customers. But, exactly, what is a web-to-print application? A driver-less printing service that allows users to print by uploading documents from a web browser is known as a web-to-print application. There is no need to install client software or drivers (Alam, 2020).

In its most basic form, web-to-print refers to the practice of conducting print business through a website (Polanish, 2018). According to Lucidpress (n.d.), web to print softwares provides a dependable way to print marketing materials on a consistent basis. Online storefronts that hosts printable collateral library will make it easier for anyone to access and print what they need, when they need it.

According to Alam (2020), web-to-print enables printers to produce more quickly and efficiently, while also improving customer experience and satisfaction. It's more than just online shopping for customers and printing services for businesses. The following are six reasons why web-to-print solution is the future of the printing industry.

Web-To-Print Reduces Administrative and Inventory Costs. Ordering on demand relieves you of the burden of inventory management. W2P technology allows for product self-customization as well as pricing and invoice solution customization, reducing pre-production involvement times.

View the Catalog of Products in a More Centralized Way. The W2P system allows one to view a product catalog and print orders all in one place. It consolidates all of the business data pertaining to print jobs. It is time-saving when looking for previous orders and related information.

Increases the Ordering Capabilities Remotely. With the successful incorporation of web-to-print technology into a business, anyone can to log into the system from any location at any time. Print companies can handle multiple purchase orders remotely with ease. Web-to-Print also allows a full administrative approval capabilities in the system to manage purchasing processes from anywhere at any time.

Access & Order Whenever You Want. Customers can place orders any time, even during off-hours, thanks to the web-to-print interface. There is no need for the customer to wait for the printers to open. Some of the product design interfaces also include quoting or tired pricing options, which makes life a lot easier especially those who are on a tight deadline.

Receive Proof Approval Virtually. By incorporating a web-to-print technology into a business, the customers can eliminate the need to travel to receive proofs. The customer can review the design proof on a device and give an approval for production. It saves them the time and unnecessary travel, and it speeds up the production process. Everything is only a click away.

Fast Order Processing. Having an online business page gives the admin the option of the manner of receiving a print-ready file such as PDF/JPG/SVG or PNG. The admin can send the print file directly to the printer company for quick production. It speeds up the ordering process by a factor of a hundred.

Almost every printing company is talking about web-to-print technology or is in the process of incorporating it into their current business process. Using this technology enables printing companies to take advantage of the inherent potential of the World Wide Web to not only reach a larger customer base, but also to improve and optimize their service offerings (Agarwal, 2021).

Web-to-Print enables your business customers to manage their printing requirements. They can get the printing services they want when and how they want it. All the printing services provider needs to do is select the best web-to-print solution and integrate it into their current business model. This is also good for the business reputation as customers will have good things to say about your printing company (Agarwal, 2021).

PDF As A Printing File Format

Portable Document Format (PDF) is defined as file format that was developed for printing use as an evident proofreading tool before being submitted to printers. This is now the preferred tool and has become the standard in the industry for sending documents that

are ready to print thru internet (DeWitt 2009). In fact, this is widely utilized in professional, medicinal and other fields, even universities, companies and residences also used and adopted this file format (Deorukhkar, 2018).

Most firms in the professional industry find PDF to be very beneficial (Massart, 2015). It's been the recommended format as these contains many features and elements such as typefaces, colors, shades, and other essential properties, while still enabling to implement adjustments and prepare the file to printed (Kendall Press, n.d.).

According to Massart (2015), there are seven major advantages of using the PDF into your company operation whereas;

Document format is maintained. These are some among the issues in transferring documents created using MS Word as well as alternative office software was the appearance and format that might change completely from one device to another. It might lead to misunderstandings or cause the company appear unprofessional to customers or coworkers. In the usage of PDF format, user can feel assured that the document will be shown precisely as it was intended. It's also great for sending papers that users want to print out.

The format is ubiquitous. PDF was mostly extensively embraced across the globe because it provides excellence and efficiency at what it does. This type and format offers hassle-free preview and transfer even if the client is exchanging document to another block away or into another country, PDF will always be the secured and best option.

They have smaller file size compared to other formats. Although TIFF file type has a number of advantages over PDF, PDF offers major advantage of compression the high-

quality data into a tiny data size. That really is great for conserving spaces, especially when dealing with such a limited capacity.

The files can be protected by password. In any company regardless of its size, managing client's private and personal information are given. One of the best feature of PDF is that, it is has the possibility to be protected by a password. Allowing secured and safe information, also to avoid possible leakage of important data that can harm any business.

Compatible to other operating systems. PDF is compatible with today's main operating systems that even if the recipient is using Windows or Mac, and maybe a modern mobile system either Android or iOS devices, absolutely there is no chance of the document not being accessed and previewed.

Printing Management System

The most important thing to consider when making a business more efficient is looking for a management solution (Printmatics, 2020). A management system is a method through which an organization controls the company's interconnected parts to achieve its goals. These goals could be related to various subjects, such as consumer satisfaction, operating excellence, sustainability practices, workplace conditions, etc. (ISO, n.d.). In turn, print management software is developed (360quadrants, 2021).

Print management software (PMS) allows the company to consolidate administration and save printing costs by offering capabilities to monitor control effectively and manage its whole printer network from a unified user interface (Plus Technology, 2013). With capabilities such as queueing, print monitoring, print releasing,

and, etc., the print management solution aid businesses to manage how, where, and what is printed to reduce maintenance (Computer Plus, 2020).

According to Xenith (n.d.), print management systems assist in removing waste and decrease print expenses by up to 30%. It manages print by considering key issues such as:

Not knowing who is printing what and where. Print management systems enable important data about print equipment, networks, and individual users or community groups.

Quickly and successfully handling print processes. Administering several print queues and drivers may be time-consuming and inconvenient. Print management software significantly simplifies the process.

Inadequate document protection. Print management systems allow users to pick up print jobs from any device via tapping into its entrance access pass. In addition, it increases security by releasing pages from the printer unless the card is used, resolving prevalent problems when personal printers weren't available.

Managing paper waste generated by undesirable or ungathered print jobs. Print management software prevents print jobs from piling up in the output tray, which might eventually become buried in a pile of uncollected prints and therefore squandered. Thus it allows users to pause and reconsider before sending its work to print.

Digital Transaction

A cashless economy has aided in the reduction of black money and counterfeit currency, as well as the reduction of cash-related robbery and the improvement of the country's economic progress (Rashmi, 2018). A cashless transaction is one in which no physical money is exchanged between parties and is accomplished through mobile payment

applications and other accepted payment methods that can be accessed online. Consumers prefer it since it is convenient and involves little risk. They are more likely to recommend it to others in order to share their appreciation (Cristobal et al, 2018).

The adoption of cashless payment has a strong association with perceived technology security. This adoption is positively connected to hedonic motivation, social influence, and innovativeness (Bahri, 2020). Consumers benefit greatly from the use of cashless payments as it provides a quick and convenient transaction. (Teo et al, 2015). Along with the innovations and techniques in technology, there are more reliable, quick, and assured cashless methods of payment developed and continuous enhancement of the previous systems. Provided in the graph shown, depicts a rise of engagement in the cashless methods of transactions in different locations throughout time on Figure 1 by Gundaniya (2021).

Figure 1. Number of cashless transactions worldwide

Source: https://www.digipay.guru

A report by SDPPH (2021) says that the development of transactions digitization in the country in 2019 and the first quarter of 2020 is documented in this feature's analysis. The study investigates the trend of key payments use cases identified in the earlier 2019 edition, indicating that single payments, like bank deposits and transfers, tend to be significant determinants to expansion.

The report's results indicate a significant increase in the value and volume of online wallets. This is promising, as the Bangko Sentral ng Pilipinas (BSP) decides to maintain a finance sector and adopt supporting policies and legislative reforms in order to promote a safe, secure, and trustworthy payment and settlement process to ensure ethical payment systems for everyone.

An article published by Gundaniya (2021) explains that a society that proceed cashless involves benefits such as:

Lower business costs and risk. Payments that are done via cashless methods reduce business concerns and problem that includes unlawful acts mainly stealing. With that, it helps the business to reduce the cost in terms of security and records.

Speed transaction. Quicker transactions can absolutely enhance the customer satisfaction, and can emit fewer errors than before. The reason that companies switch and apply cashless mode of transaction is to generate short lines and accurate transactions. Similar benefits were discovered by the Sweetgreen and Salad King Companies wherein cashless outlets, specifically at an hour, could achieve transactions than the usual.

A study of Davies (2017), examines university students' attitudes and views of cashless financial transactions. The purpose was to determine motivations in the adoption in the cashless methods of transaction and acquire a better understanding of university

students' attitudes on cashless transactions. The study found that convenience, ease of usage, and the aspect of time savings were the most important factors in choosing a payment method. The findings revealed that the younger generation is more likely to embrace cashless payment methods in order to take advantage of new and improved payment technology. According to the findings, cashless financial transactions are preferred because of the benefits they provide. Furthermore, because to the psychological attachment and enhanced value associated with cash, the study found that it is more beneficial for personal budgeting. Due to regularity and general convenience, the study determined that cashless transactions will not be replaced as a primary method. The study suggests that students' views and impressions of cashless financial transactions are good, owing to the numerous benefits associated with their use, which contribute to less effort in their daily lives. Furthermore, the drawbacks of cashless transactions are insignificant enough to discourage the use of other payment methods.

As cited in the Journal of Singh (2017), increased internet and cellphone use are also contributor to the significance of the digital payment method. Digital payment refers to consumer transactions done via online by the usage of cellphones along with the internet.

Selected banks in the Philippines launch a system that aims to have an increased electronic payment utilization from 1% to about 20% of total payments by facilitating smooth, comfortable, cheap, and protected fund transfers between banking institutions and electronic money accounts (Adrian, 2018). Mobile payment services are growing rapidly with each day, and they are demonstrating a transition by moving toward a promising future of speculative potential in tandem with technology advancements (Assad et al, 2017).

Advantages of Cashless Payment

According to Dave (2021), as countries proceed to digital transaction, the advantages of cashless payment are as follows:

Convenient. When traveling, large amount of money won't be carried that made it secured and more convenient way to spend. Also, wait in lines in an automated teller machine for withdrawal will be avoided.

Tracks Spend. It will also aid in the filing of income tax returns, and people would find it easier to explain their expenditures if they are audited. In addition, customers recorded transactions made it easier to track the history of expenses.

Lower Risk. Digital payment choice provides minimal attention such as when traveling, particularly internationally, when losing cash can be extremely inconvenient that lower the risk.

Business that will be going cashless can substantially speed up the check-out process, reduce queueing time, and enhance the likelihood of customers who are in a hurry stopping in to make a purchase for businesses that frequently experience long lines, especially during peak times like commuting hours (Pearce, 2020). It's simple to take money. Illegal transactions are usually done using cash because there is no record of the transaction and the seller knows they will be compensated (Strauss, 2020). Gathering cash takes time and exposes you to the risk of human accounting errors. Mobile payment reduces the risk of miscounting and makes your accounting process easier to monitor (Hamilton, 2021).

According to eCompareMo (2020), as virtual payment solutions keep track of all your transactions, they provide an extra layer of protection against account discrepancies.

In the event of refunds, transaction mistakes, or other payment problems, you can contact customer service. It makes sense for some business to move toward a cashless future. After all, only one out of every four people carries cash, and simply accepting cashless payments means increased efficiency, reduced theft risk, and increased spending (Wood, 2020). Muggings, store and residential break-ins, and handbag theft are just a handful of the crimes that would most likely disappear (Howat, 2020).

E-Wallets

As part of the government effort to increase access to financial services, the Philippines is progressively implementing digital payments. As per data provided by the Bangko Sentral ng Pilipinas, total users of digital wallet has increased annualy. Last year, e-wallet growth outpaced other payment methods that increased from the previous record (Kapronasia, 2019).

According to Pobre (2020) in the Philippines, e-wallets have been launched, allowing people to pay without having to use currency. We can now buy from internet stores all over the world and even pay our bills without leaving our houses thanks to e-wallets. GCash, GrabPay, LazadaWallet, and PayMaya are among the e-wallets accessible in the Philippines.

According to the article of Kapher (2019), the number of registered digital payment users in the Philippines are as follows:

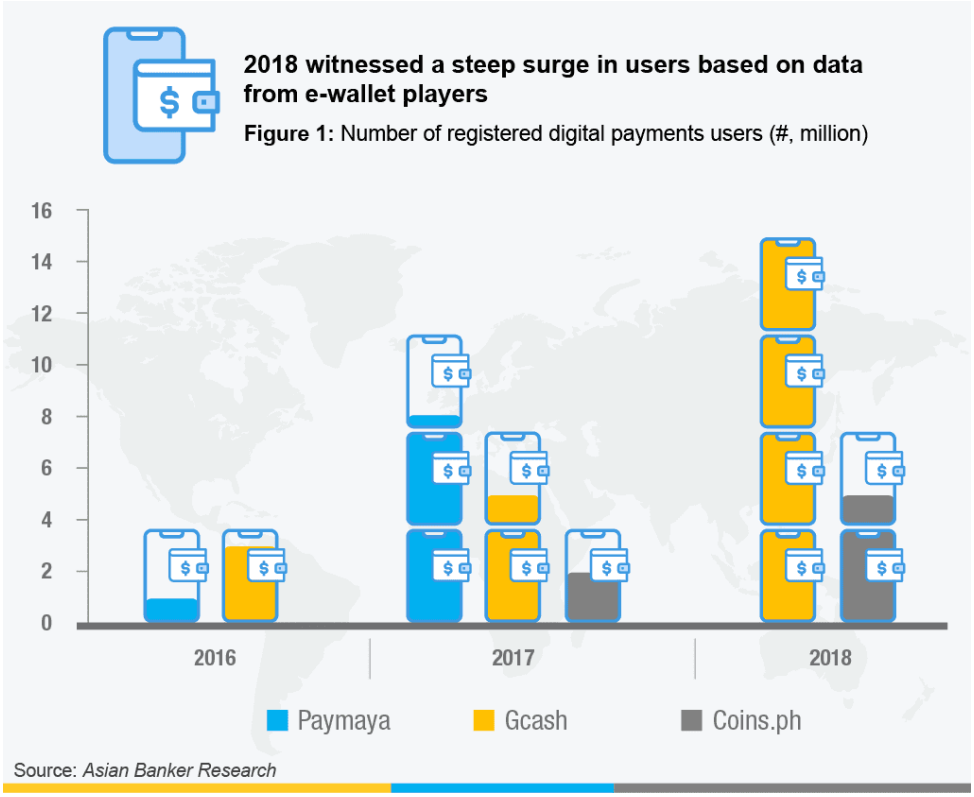

Figure 2. Number of Registered digital payment users

Source: https://www.theasianbanker.com

Paymaya

PayMaya is the first end-to-end payment systems industry facilitator in the Philippines, offering systems and technologies for consumers, retailers, neighborhoods, and authorities. It is the leading mobile money facilitator for some of the state's greatest businesses, hotels, gas stations, and online stores. PayMaya's aim involves giving the unbanked access to the digital products. This is achieved through a wide network of over 37,000 partnering agent contacts that act as last-mile online payments centers in remote communities (Kovitsun, 2021).

Digital wallets was utilized in the country mainly of its ease, costs absence, and various functionality, according to executives at PayMaya, Voyager Innovations' fintech subsidiary. Digital wallets are quickly becoming the "top payment method" for Filipino customers, according to the director of Paymaya. PayMaya has launched a cashless QR code-based ecosystem on Boracay, a major vacation island south of Manila, allowing guests for the payment method utilizing cellphones in different merchants that includes accommodation and retail dealers available in the said area (Kapronasia, 2019).

According to the article in Inquirer (2021), PayMaya provides financial services to more than 28 million Filipinos. Customers can pay, add money, cash out, or remit money through the company's nearly 200,000 digital touchpoints across the country. It is the country's leading digital payments processor serving important industries, including "everyday" retailers, through its enterprise business.

Gcash

The G cash service is designed to the Philippine microfinance industry. Individuals could immediately pay their mortgage prepayments, and the massive base of G-Cash retailers in handy areas made it even simpler. It is also more cost-effective because microfinance users save time and resources by not having to drive far to pay their loan mortgages.

In such a limited timeframe, G Cash has evolved significantly. It is now one of the most economical, reliable, and secure methods of payment system and obtain prestigious award in 2005. Rural Philippines' banking system particularly in mobile is now one of the most advanced and powerful. The company strategy supplied banking

opportunities/facilities to the unbanked. In the area of microfinance, GCash widen the scope, also the possibilities to the banking industry.

GSave savings account will only be accessible on the GCash service. The business also declared that they will engage in the future to make further financial services new items to GCash users. This is a potential for Filipinos to move further away from consumption-driven budgeting and toward aspirations of the economically destitute. Only 15.8 million mature Filipinos, or 22.6 percent of the entire population, own bank accounts, as per data released by the Bangko Sentral ng Pilipinas (BSP). The 500,000 new GCash clients after just six months suggests that a good percentage of Filipinos are up to date with current investment banking trends (Cudis, 2021).

Today, physical isolation and significant in the nation, Filipinos switched to online services since the community quarantines started. Companies have installed their individual electronic shops to continue production as marketplaces have got busier. Food delivery and internet shopping have risen in popularity, and transactions, also used as a common approach in national transfer (Ramirez, 2021).

Effect of Online Payment

The cashless transaction is a new mobile payment application that may be used to replace a traditional wallet and more. Banks are prioritizing mobile payments as a high investment priority. In fact, the majority of the world's largest banks' declared to focus on IT plans on mobile financial services (as well as payments) and web banking. At present, the cashless transaction is one of the most dominant concepts for a Cashless Economy. In a cashless economy, citizens enjoy from the reduction of the risk of having monetary notes and the misuse of hard-earned money. Market prices, payment duration, and business

charges will all be minimized. Cashless arrangements are favorable for shopping, settlement of accounts and organizing of financial settlements managed from home, workplace or wherever with a smart gadget. It also narrows dissipation on producing copies of currency memos and its transportation (Thirupathi et al, 2021).

Cashless payment through digital platforms, a new application of e-commerce, refers to a smart payment alternative in some evolving countries to obtain a sustainable competitive edge. Utilization and consumer conduct are critical elements in societies, distinctly during the COVID-19 outbreak in the year 2020. Consumer's deportment has been greatly affected by digitization. Also, it has resulted in new methods of living. E-payments have been enhanced with the growing promotion of online services beside the enlargement of suppliers and the proportions of their networks. The publication of digitalization via the web has hastened the course of globalization. Today, e-wallets and internet transactions have directed issues associated with cash control and long-distance arrangements. Furthermore, digital wallets may be regenerated by another interchangeable tool with money in its wallet using any system of arrangement. The promotion of utilizing e-wallets is correlated with digital currency by using e-banking, debit or credit cards, and other payment programs to intensify the point of sales at any given time and place. In addition, digital wallets clarify purchasing and trading arrangements via the utilization of smartphone applications, which allows one to settle internet shopping swiftly and without difficulty. Despite these advantages, digital wallets create security threats, dictate one’s gadget to be charged, and may escort to careless spending (Yang et al, 2021).

Development Tools

Visual Studio Code

An article authored by Dechalert (2021) discussed that Visual Studio Code is a well-known coding editor that is used by millions of developers worldwide. Visual Studio Code was ranked 13th among the most popular development tools on Stackoverflow in 2016. According to the 2019 Developers Survey, this code editor quickly rose to the top spot, with 50 percent of 87,317 respondents using it.

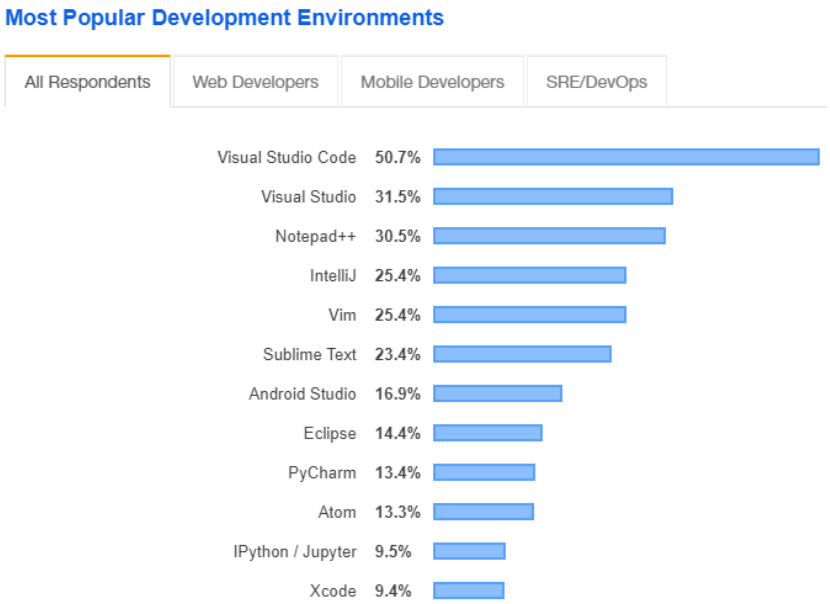

Figure 3. Most Popular Development Tools 2019

Source: https://insights.stackoverflow.com/survey/2019

According to Cangemi(2021), its popularity stems from the growth of the web development field in recent years, as well as the need of developers for a lightweight well-done editor with few features but less complexity than others on the market.

Visual Studio Code combines the ease of use of a source code editor with powerful developer features such as IntelliSense code completion and debugging. The smooth edit-build-debug cycle means you spend less time fiddling with your environment and more time executing on your ideas. Here are some beneficial features according to Visual Studio Code (2021):

Simplicity. Unlike many other similar software, Visual Studio Code includes a in-built debugger, allowing the development flow to maintain a single view with code and debugger, making bug tracking and code run-throughs much easier and faster. There won't be a need to have multiple screens to run the different consoles and rearrange them each time there is a need to minimize something as it is already incorporated into the design and the required workspace set up.

As developers begun using this code editor, they were impressed by how simple and intuitive it is. The fact that it is not an IDE packed with features has little impact on VScode's coding experience because it includes IDE features and functionalities that are added in a user-friendly manner.

Although the main feature of Visual Studio Code is that it is a code editor, with the addition of extensions, it becomes much more than that. It can easily become a full-stack workstation with the right settings, extensions, and configured shortcut keys. In fact, it is an integrated development environment (IDE), which means that developers can write and test code simultaneously (Dechalert, 2021).

For serious coding, you'll often benefit from tools that understand more code than just chunks of text. IntelliSense code completion, rich semantic code understanding and

navigation, and code refactoring are all built into Visual Studio Code (Visual Studio Code, 2021).

Extensibility. VS Code also syncs with build and scripting tools to perform common tasks, which speeds up daily workflows. VS Code supports Git, allowing developers to work with source control without leaving the editor.

Many extensions for Visual Studio Code were created by its teams and contributors around the world. Every day, new extensions are added to the VS code marketplace. Because developers build these extensions, they are often successful and popular because they are developers who understand what the developer requires in his daily tasks.

Robust and Extensible Architecture. Visual Studio Code's architecture consists of a combination of web, native, and language-specific technologies. It uses Electron to combine web technologies like JavaScript and Node.js with the speed and flexibility of native apps. VS Code employs a newer, faster version of the same high-performance HTML-based editor that powers the "Monaco" cloud editor, Internet Explorer's F12 Tools, and other projects. VS Code also employs a tools service architecture, allowing it to integrate with many of the same technologies that power Visual Studio, such as Roslyn for.NET, TypeScript, the Visual Studio debugging engine, and others.

Free, Open-Source, and Cross-Platform. VS Code is open-source, cross-platform, and free. Developers have no objections using this platform at work because it as free. And because it is free, it encourages many users to share to it’s codebase. As a result, this code editor is constantly improving and growing stronger, making the VS code community motivated and engaged in improving it. This also means that it is compatible with Windows, Linux, and macOS.

Evolution. Because of its community involvement, VS code is rapidly evolving. Every day, new features are added. Problems are quickly resolved. The difference between VS Code versions and the most recent ones is astounding (Fam, 2022).

Bootstrap

Infinity (2022) defined Bootstrap as an HTML, CSS, and JavaScript-based Frontend Development Framework. Bootstrap allows designers and developers to easily create fully responsive websites. It is the most widely used CSS framework for creating responsive applications and mobile-first frameworks for web development.

Bootstrap takes care of everything for you. Even if you are not knowledgable about coding, you can still use Bootstrap to create an appealing landing page. The only requirement is that you have a bit of experience with CSS and HTML. Additionally, the Bootstrap integration process is simple on both existing and newer websites (Success, 2021).

Using the Bootstrap framework saves time in a variety of ways by utilizing reusable code for Navbars, Dropdowns, Labels, Alerts, List groups, and JavaScript plugins.

The Benefits of Bootstrap Front-end Development

Bootstrap includes a large number of open source plugins and components, so it only takes a few clicks to start using your front-end resource. Staff members can save many hours that would otherwise be spent on repetitive coding. The Bootstrap framework has the following advantages according to Clarity (2020):

Consistent Designs. Bootstrap was developed with the intention of creating a framework to facilitate consistency across web pages and internal applications.

Access to Support. The open source community is willing to assist you in troubleshooting issues and bugs. Bootstrap is regularly updated and maintained on GitHub by over 5,000 expert contributors.

Fast Development. Today's B2B and B2C marketing requirements are frequently time-sensitive, and a quick development option is required to compete with other agile companies. Bootstrap allows designers to quickly create new websites by utilizing pre-existing code blocks.

Responsive Business Actions. Between 2013 and 2015, when the global mobile marketing increased 1,100% the Boostrap developers took advantage of this opportunities, thus responsive projects are frequently required. Bootstrap includes a 12-column grid system that allows developers to easily build for different screen sizes, and developers can choose to show or hide each portion of the grid for specific operating systems. This responsiveness expedites the creation of personalized screen displays for faster mobile marketing.

Customizable Expansion. Companies are not constrained by one-size-fits-all constraints. Bootstrap can be modified in variety of ways to create websites that differ from the original. It is easy to get rid of unnecessary code. Bootstrap can be tailored to the specific requirements of each project. Developers simply need to determine which aspects of the Bootstrap customize page are required. It's simple to uncheck items like grid systems, forms, tables, buttons, badges, pagination, and JavaScript components. This effort provides a unique Bootstrap version for each project.

Loaded JavaScript Components. Loaded Bootstrap includes a set of JavaScript components that make it simple to open modal windows, trigger alerts, and so on. These parts can be reused or discarded.

Easy to Integrate. The flexibility of Bootstrap includes simple integration into the platform's API layer. Designs can coexist with pre-existing pages, websites, apps, and operating software.

The advantages of Bootstrap include the ability to create stunning designs in record time in order to capitalize on business opportunities, regularly refresh company websites, and reduce development costs.

Node.JS

Denman (2012) stated that Node.js Node.js (Node) is an open-source server-side execution platform for JavaScript. Node is commonly used for real-time applications like as chat, news feeds, and web push notifications and is ideal for designing apps that require a persistent connection from the browser to the server. In agreement with Kopecky (2020), Node.js is a cross-platform, open-source JavaScript runtime environment that allows you to run JavaScript code outside of a browser. Many large firms, such as Netflix and Uber, use Node.js, a popular, lightweight web framework for newbies.

Express.Js

ExpressJS is a Node.js online application framework that is both lightweight and adaptable, providing comprehensive capabilities for both web and mobile apps. The foundation of NodeJS developed and maintains ExpressJS, which is also an open-source framework. The Express.js' framework makes it simple to build an application that can handle a variety of requests as explained by Hartman (2022).

ExpressJS is a NodeJS framework that may help you create server-side web applications more quickly and intelligently. Its qualities include simple, minimal, and adaptable. And because it is built on NodeJS, it acquires its performance as well. ExpressJS, in a nutshell, accomplished for NodeJS what Bootstrap did for HTML/CSS and responsive site design (Agarwal, 2014).

Postman

Postman is an API platform that allows you to create and use APIs. Postman simplifies collaboration of the API lifecycle allowing you to create better APIs faster (Postman, n. d.).

Every month, over 5 million developers use it to build their API development easy and simple. It can make various HTTP requests (GET, POST, PUT, PATCH), save environments for later use, and convert the API to code for various languages (like JavaScript, Python).

Although it is free to use, Postman provides a paid version with pro features such as multiple user access, control over roles and access, SSO authentication, and so on. Postman is an ideal Testing Tool because it allows users to set up the required environment, write specifications, and finally monitor every step (GeeksforGeeks, 2021).

Github

Github, which has been around for over ten years, is one of the most visited websites in the world, with over 36 million users and 100 million code repositories. It is a website that wraps "Git" (a software version control system) and allows developers to freely host their code online. It's essentially a place where code can be stored, exchanged, traded, and discussed (BitBand, 2020).

Kinsta (2021) defined GitHub as a website and cloud-based service that allows developers to store, manage, and track changes to their code. The robust version control system on GitHub is one of its distinguishing feature. Version control allows programmers to make changes to software, such as fixing bugs or increasing efficiency, without affecting the software itself or jeopardizing the experience of the current users. After the proposals have been reviewed and approved, they can be easily merged into the live software (Bradford, 2020).

Ouellette (2021) said that when starting out as a web developer, it can be easy to get lost in the multitude of languages, tools and platforms that are available in today's market. However many would argue that GitHub is an essential platform for every web developer at every level and here's why:

1. GitHub makes version control easier.

A good Version Control workflow is essential whether you are developing in Ruby, JavaScript, Python, or any other language, GitHub makes implementing workflow simpler by providing developers with great tools to work with

2. Graphical interface.

GitHub creates an intuitive and powerful graphical interface for the Git versioning system. You can easily see your repositories and browse through its list of commits. If you want to see the changes made in one of your commits, it is as simple as clicking on the commit from the list and GitHub will present you with the differential. Much simpler than typing commands in your terminal and deciphering their results.

3. Gist.

GitHub designs a user-friendly and strong graphical interface for the Git versioning system. You can easily see your repositories and browse through their commit history. If you want to see the changes made in one of your commits, simply select the commit from the list and GitHub will display the differential. It's a lot easier than typing commands into your terminal and deciphering the results.

Pastebin apps allow users to save plain text. Developers commonly use them to store and share small scripts and bits of code. GitHub developed Gist as a Pastebin-style application, but Gists also benefit from Version Control.

4. Collaboration tools.

GitHub allows you to create access rights to your code, which means you can designate specific users who can freely push code to your repository.

The Forking feature on GitHub allows users to make a copy of a repository on their computer to work on without affecting the main repository. They can edit and then use a feature called Pull Requests to request that it be merged with the main repository.

Pull Requests allow you to inform other developers about the changes you want to incorporate into the main repository. The authors of the repository can review your changes and engage in discussions about them. GitHub also has issues for repositories. Issues are a great way to keep track of bugs in your code, but you can also use it to keep track of tasks and other enhancements you would like to implement in your code. Issues are very powerful and mastering them is a great way to keep yourself organized. For more information on Issues, please see this guide posted on GitHub’s website.

5. Open source.

With so many great tools available to developers, GitHub has emerged as the go-to destination for open source software. GitHub hosts some of the most popular open source projects, including Ruby on Rails, AngularJS, Bootstrap, and many others. Some major technology companies, such as Microsoft, host code repositories on GitHub. The above-mentioned collaboration features make it simple for any developer to get involved with their favorite open source project.

You can also keep track of your favorite developers by following them or your favorite projects by "watching" them on GitHub. There are numerous ways to be social on GitHub, so go exploring and see what's going on in the world of software development.

6. Using GitHub to showcase your skills.

GitHub is a brilliant tool for making version control easier, and it is used for some of the largest projects on the internet. The fact that it is a great way to showcase your skills is perhaps its most valuable asset. A GitHub profile that includes real-world projects and contributions to open source projects is an excellent way to show prospective employers exactly what you are capable of.

Employers look for people with programming experience and who can code well when applying for developer positions. Prospective employers can be directed to your GitHub profile, which can serve as your portfolio website. Your open source contributions can also demonstrate to potential employers that you are adaptable and can easily contribute to a variety of projects, which is essential for a web developer.

7. Wrap-up.

Today, GitHub has become one of the few must-have platforms for web development. It is a fantastic tool that will make development more efficient, will help you

stand out from other web developers, and will host some of the biggest and most interesting projects available today.

Graphical User Interface (GUI)

A graphical user interface (GUI) is a user interface that allows a user to interact with electronic devices by using visual indicators or representations (graphics) Techopedia (2021).

A graphical user interface employs visual elements to present information stored in a computer in a readable form. These elements facilitate people's interaction with and use of computer software. A graphical user interface (GUI) employs windows, icons, and menus to carry out commands such as opening files, deleting files, and moving files. Because there is no need to type in and memorize individual commands, GUI software is much easier to use than command line software. WIMP represents the most common graphical elements: window, icon, menu, and pointer (Zandbergen, 2021).

Figma

Figma is a frontend developer tool for web-based graphics editing and user interface designing. It is a modern, streamlined design tool that facilitates the developer's handoff process (Figma, n.d.).

According to Wissen (2020), this design tool is browser-based which means anyone with a browser can use it in any operating system and without installing anything. It's also entirely cloud-based, so everyone is always viewing the most recent version of the design, and it includes collaboration tools that make collaborating and communicating easier than ever.

It can be used to do all kinds of graphic design work from wire framing websites, designing mobile app interfaces, prototyping designs, crafting social media posts, and everything in between. The following are its benefits as mentioned by Perera (2020).

- Offers real-time collaboration.
- Figma is web-based and works anywhere.
- Sharing is uncomplicated and flexible.
- Embedded Figma files provide real-time updating.

Programming Language

A programming language is a computer language which allows a programmer to give instructions, commands and syntax used to develop a software application (Christensson, 2011). However, developing a successful software requires choosing the appropriate programming language. Each language has its own distinct features and there are various points a programmer must consider including the type and complexity of the application, security, performance and etc. (Kumar, 2020).

JavaScript

JavaScript is a programming language that has the ability to change an action which can be used for web development, web applications, creating or developing a game, and a variety of other things. JavaScript also enables you to add various features to web sites that you couldn't achieve with only HTML and CSS. For creating interactive tasks on the web, several browsers use JavaScript as a scripting language. You can witness the impacts of JavaScript when you see a click-to-show dropdown menu, extra content added to a website,

and dynamically changing element colors on a page, to mention a few things. (Dillion Megida, 2021)

According to McKenzie (2020), JavaScript is also a programming language that began as a way to give logic and interaction to a Netscape browser that's otherwise, static. It has not only displaced a range of other competing languages and technologies to become the norm for browser-based programming in the years since its inception, but it has also gone beyond the client area to become a dominating language on the server side.

Pug

Pug is a Node and browser-based template engine. It features a simpler syntax and compiles to HTML, making you more productive and creative making your code more understandable. It also makes it simple for you to construct reusable HTML as well as render data from a database or API as stated by Hibbard (2019). In line with Ekpot (2021), Pug is a templating engine for server-side technologies like Node.js that generate HTML. It facilitates authoring reusable HTML code and presenting dynamic data, much like any other JavaScript templating engine. Pug is also previously known as Jade,

CSS

As stated by McKenzie (2020), CSS may also change the layout of numerous elements of a page, including as the header, footer, body, article content, sections, and asides. This is incredibly useful when content needs to be formatted differently based on whether it's being read on different gadgets such as desktop, tablet, or mobile phone.he industry standard for formatting HTML pages.

Database Management System

Databases contain quest-critical, safety-sensitive, and compliance-concentrated data items that have complex logical linkages with all other datasets and expand enormously as the user base grows. In conclusion, organizations demand innovative solutions to manage, protect, govern, and interpret database data. Database Management Systems are useful in this situation (Raza, 2018).

A DBMS is a system that employs a technique of categorizing, accessing, and indexing different data (Christensson, 2006). A DBMS controls data, file system, data types, document architecture, and memory space. This even specifies analysis process and modification rules. (Technopedia, n.d.).

Because it is one of the simplest DBMS design, relational DBMS is the most extensively utilized. The data in the quadrants of the tables is normalized in this model. (Guru99, n.d.). It perpetuates information and divides it into logically distinct groups. Upon those tables, it can execute operations like "Select" and "Join." SQL is used to employ the data, which is stored in fixed structures.

As per Naeem (2020), linked DBMS offers user information that illustrates connections amongst distinct datasets. The trustworthiness of the linkages between tables is guaranteed since information inside one table can relate to existing records in some other table.

The NoSQL database is an alternative to the traditional SQL database. This type of database provides almost all of the features that are typically found in RDBMS systems. NoSQL databases have grown in popularity in recent years because of the simple design, support for both horizontal and vertical scaling, and easy and simple control over the stored data (Saha, 2021).

MongoDB is the most well-known of the new generation of non-relational NoSQL databases. It's a document database, also known as a document-oriented database or a document store (Wang, 2021).

MongoDB

MongoDB is based on a scale-out architecture, which has gained popularity among developers of all types for developing a scalable application with evolving data schemas. MongoDB, as a document database, makes it easier for developers to contain structured or unstructured data. It stores documents in a JSON-like format (MongoDB, n.d.).

According to Shah (2022), MongoDB uses the key-value pair format, also known as document store. Documents in MongoDB are stored in BSON files, which are essentially a slightly modified version of JSON files, and thus all JS are supported. As a result, it is frequently used in Node.js projects. Furthermore, JSON allows for the exchange of data in a human-readable format between web apps and servers.

Software testing

Many startups fail to test their products. They may claim that their limited budget is the cause for their failure to take such a crucial move. They believe it will have no significant impact. However, in order to produce a high-quality product and make a good first impression, something must be in place to detect faults. For software development organizations, software testing is a critical answer to this challenge (Testim, 2020).

Software testing is defined by Rajkumar (2021) as the process of evaluating a software's functionality with the purpose of identifying whether the generated software met

the specified requirements and identifying errors in order to deliver a quality product. The following are some of the reasons why testing has become so important.

Cost-effectiveness. Any complex system's design flaws can never be totally eliminated. It's not because engineers are irresponsible, but because a system's complexity is insurmountable. It will be more difficult to track back errors and correct them if design flaws go undiscovered. Repairing it will become more expensive. This is why it is critical to identify issues in the beginning of a software development life cycle.

Customer Satisfaction. Any organization's ultimate goal is to provide the highest level of client satisfaction. Software testing improves an application's user experience and increases customer satisfaction.

Security. Testing contributes to product security (penetration testing and security testing). Testing aids in the elimination of product flaws that could allow hackers access.

Product Quality. Software testing contributes to a company's market reputation by providing a high-quality product to the client in accordance with the specifications outlined in the requirement specification papers

According to Hossain (2021), testing a software is broadly classified into two types: functional testing and non-functional testing.

Functional Testing. This refers to the testing of a software application's functional aspects. When performing functional tests, testing of each and every feature is a must. It must determine whether or not are the desired results are achieved. Functional tests are carried out both manually and with the assistance of automation tools. Manual testing is simple for this type of testing, but tools should be used when necessary.

Non-functional testing. This refers to the testing of a software's non-functional aspects such as performances, usability, security, and so on. Non-functional tests are carried out following the functional tests, this is to improve the quality of the software even further.

This type of testing is not concerned with whether or not the software works. Rather, it is about how well the software runs and a variety of other factors.

Non-functional tests are rarely run by hand. In fact, performing these types of tests manually is difficult. As a result, these tests are typically carried out with the aid of tools.

Software testing is an essential part in the development of the software product. This is because testing the software improves consistency and performance. Additionally, this allows developers to evaluate the expected results to improve the software's quality. If software is created without being tested, it may be ineffective or even dangerous to customers (Sharma, 2019).

Software Evaluation

Software evaluation is an evaluation method which examines whether the system of program is suitable to the client's needs. This is done by examining the resources and tools that are presently being used or considered as an addition to the software (Tatum, n.d.).

ISO 25010

ISO 25010 is a software quality standard used in software evaluation. It is made up of eight product quality characteristics and 31 sub-characteristics. These characteristics and sub-characteristics offer standardized terminologies which specifies, measures, and evaluates the software's quality (Britton, 2021). These characteristics are defined by ISO (2011) under the two software quality models of ISO 25010 namely; the model of product quality and model of product quality in use. The main difference between these two is how they classify and define software quality requirements.

Figure 4. Product Quality in Use Model

Source: https://www.researchgate.net

Product Quality in Use. This is made up of five attributes that are related to the outcomes of interaction when a product is used for a particular circumstance. Product Quality in Use characteristics include effectiveness of the software, efficiency, customer satisfaction, freedom from risk, and coverage of the context (Codacy, 2021). It is further separated into sub-characteristics as illustrated in figure 6.

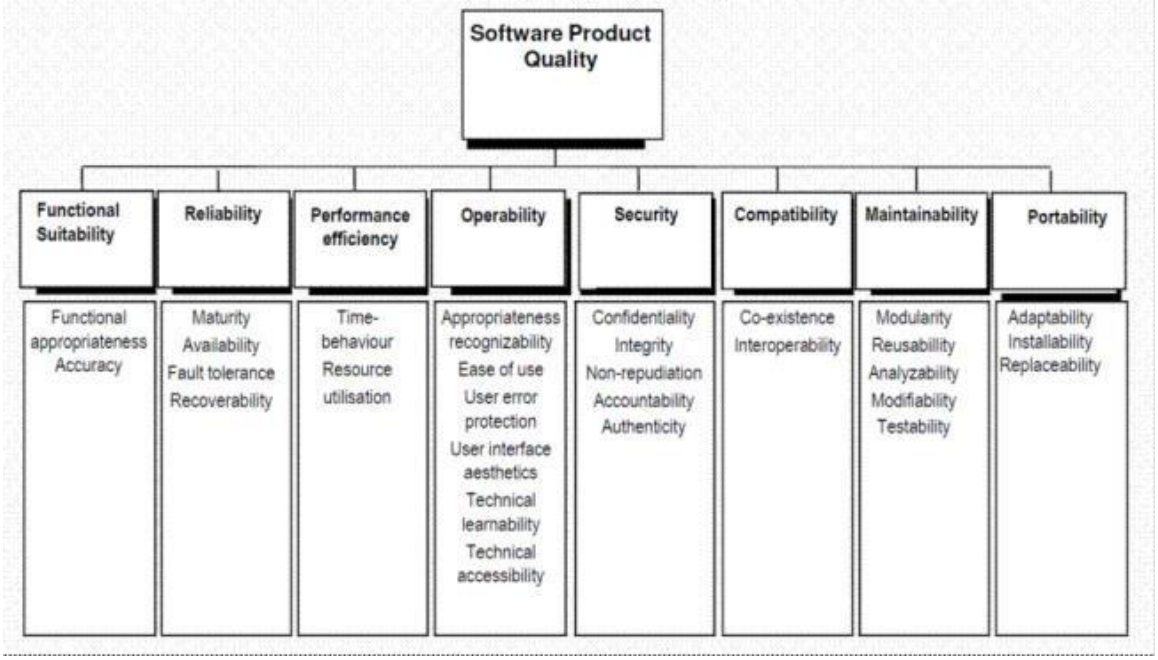

Figure 5. Product Quality Model

Source: https://www.researchgate.net

Product quality. This model has eight features namely: functional suitability, performance efficiency, usability, reliability, security, maintainability, portability, and compatibility. As shown in Figure 7, these characteristics are further separated into sub-characteristics.

Functional suitability. Evaluates the ability of the system to perform functions that are needed.

- **Functional Completeness**. When the set of functionalities covers all of the tasks and goals.

- **Functional Correctness**. When the function produces accurate results with the required precision.
- **Functional Appropriateness**. When the functions assist in the completion of specific activities and goals.

Performance efficiency. Evaluates the software's ability to perform the functions under specific conditions

- **Time-behavior**. The extent wherein the system's response, processing, and throughput rates meet criteria.
- **Resource utilization.** When the system satisfies needs in terms of the quantities and types of resources used to perform its functions.
- **Capacity**. When the system's limitations fulfill the specifications.

Usability. Evaluates how effectively, efficiently, and successfully the system can be used to meet the objectives.

- **Appropriateness Recognizability.** When users can determine whether the system is appropriate for their needs.
- **Learnability.** When a system enables the user to understand how to use it effectively and efficiently in an emergency.
- **Operability**. The ease with which the system may be operated, controlled, and used.
- **User error protection**. The extent to which the system prevents consumers to make mistakes.
- **Aesthetics of the user interface**. The extent wherein the user interface enables enjoyable and fulfilling interaction.

- **Accessibility.** The extent wherein the system can be used to achieve a specific goal in a particular setting by people with a diverse set of qualities and abilities.

Reliability. Reliability relates to how successfully the system performs in a certain function under a certain circumstances.

- **Maturity**. When the system meets the reliable specifications in normal use.
- **Availability**. When system is functioning and is available when it is needed.
- **Fault-tolerance**. When the system performs as expected regardless of the software flaws.
- **Recoverability**. In the event of a problem or malfunction, the system can regain seriously affected data and ensure the data to its desired state.
- **Security.** Security evaluates how successfully the system protects data and information against security flaws.
- **Confidentiality**. The extent to which the prototype guarantees that the data is usable to those granted with access.
- **Integrity**. When the system protects computer programs or data from unauthorized access or change.
- **Non-repudiation**. When acts or incidents can be shown to have taken place in a way that it cannot later be refuted.
- **Accountability**. When an entity's behavior can be tracked down solely to it.
- **Authenticity**. When the identification of the subject can be confirmed to be the only one stated.

ISO 25010 is a perfect device for defining software metrics that are important for this project. It assists the developers depending on the situation. Every development project

has its own set of priorities and metrics, and this standard allows for enough flexibility to accommodate them all (Rebeś, 2019).

Conceptual Model of the Study

The conceptual model was developed based on the fundamentals, principles, and findings of the related studies presented as shown in Figure 8.

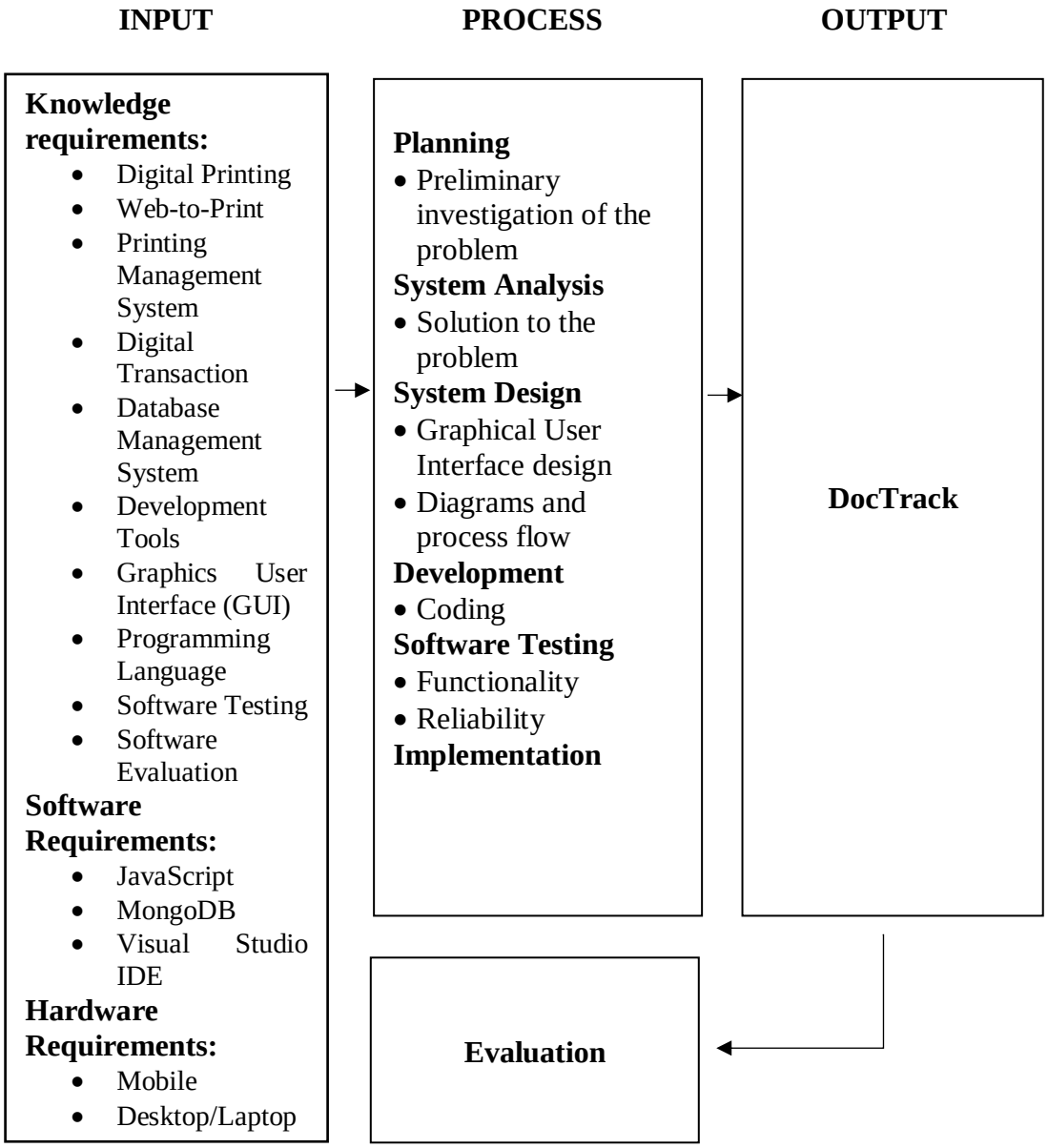

Figure 6. Conceptual Model of the Study

The conceptual model of the study as shown in figure 8, discusses the process on the development of the study. This process is divided into three phases: Input, Process, and Output. These requirements are important in the creation and implementation of the project.

The input phase is divided into three areas namely: knowledge requirements, hardware requirements and software requirements. Knowledge requirements include: Digital Printing, Web-to-Print, Printing Management System, Digital Transaction, Database Management System, Development Tools, Graphics User Interface (GUI), Programming Language, Software Testing, Software Evaluation. The software requirements needed are JavaScript, MongoDB and Visual Studio IDE. While for the hardware requirements, a mobile phone and a desktop/laptop are required.

The process phase is divided into six phases: Planning, System Analysis, System Design, Development, Testing and the Implementation of the system. The output phase includes the final product of the DocTrack app. And for the evaluation, that is the assessment and feedback of the end-users on the DocTrack app.

Operational Definition of Terms

To further understand the factors that were discussed, the following terms have been operationally defined:

Admin. Refers to the owner of the printing hub. The admin is the one who manages and takes into process the files needed to be printed.

Client. Refers to the people who will be using the mobile application. In specification, these are the students of the Technological University of the Philippines.

Digital Transactions. Refers to the transaction to be made in the application through the use of Gcash and PayMaya.

DocTrack. Refers to the mobile-based application which allows students, teachers, and other personnel in TUP to send documents to be printed in a printing server.

Database Management. Refers to where all the data such as customer list, list of orders, and etc. are stored and retrieved.

ISO 20510. Refers to the metrics that the researchers will use in order to evaluate the system.

PDF File. Refers to a file format that will be used to share the documents to the printing server. PDF is used as a file format to ensure that the print-ready documents to be shared will not change when it is viewed and printed by the admin.

Web-to-Print Solution. Refers to an online ordering website that can be accessed on a web browser. This allows customers to upload a file online to be printed by the store.

Chapter 3

RESEARCH METHODOLOGY

This chapter covers the project design, project development, operation and testing procedure, test plan, implementation plan and evaluation procedure.

Project Design

This study is focused on the overall functionality of the system. This part discusses the block diagrams and flow diagrams of the software system.

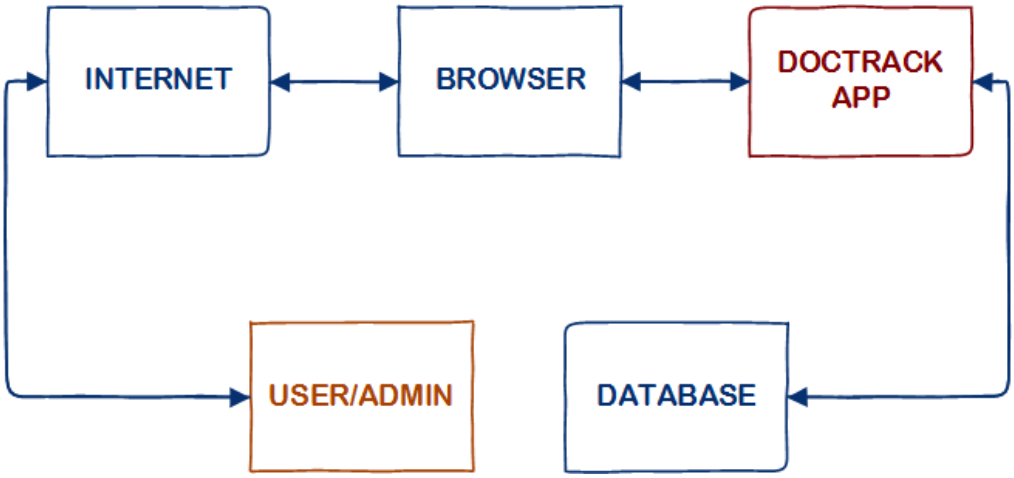

Figure 7. Block Diagram of the System

Figure 9 shows the block diagram of the system. The figure shows the overview of the system using the major parts as blocks. The five blocks; User/Admin, Internet, Browser, Doctrack App and Database, describes the flow on how to access the system. If the user/admin wants to access the Doctrack App and its data, it needs to be connected to the internet, then the browser. And when data is accessed, the Doctrack app and database will communicate with each other.

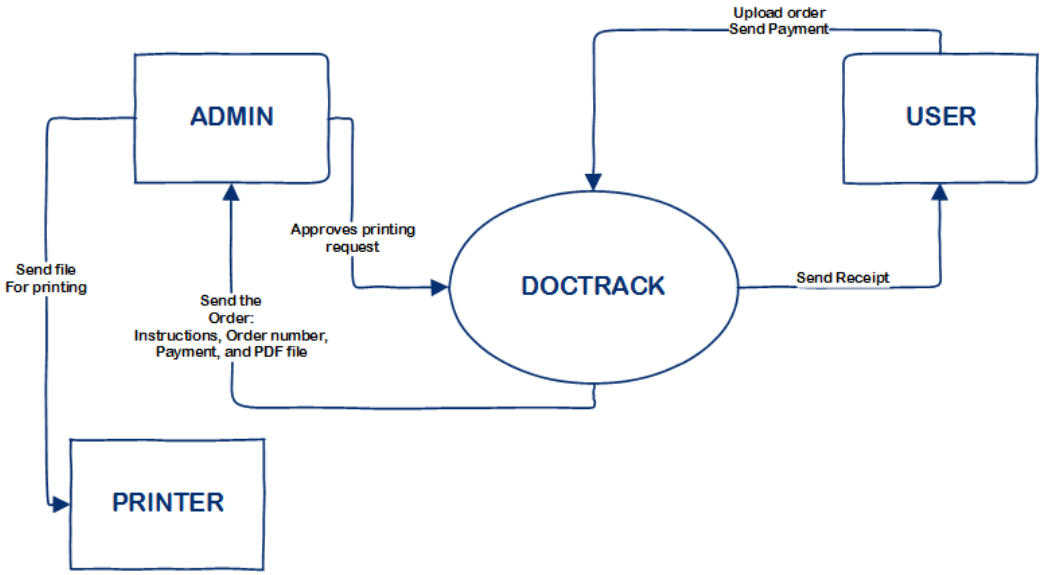

Figure 8. Context Diagram of DocTrack App

Figure 10 shows the context diagram of Doctrack app. This shows the steps on how the file uploaded are to be sent for printing. First, the user uploads the print-ready PDF file and payment to the Docktrack app. The admin then receives the order which contains the instructions, order number, payment and PDF file. Once approved, the Admin will print the files.

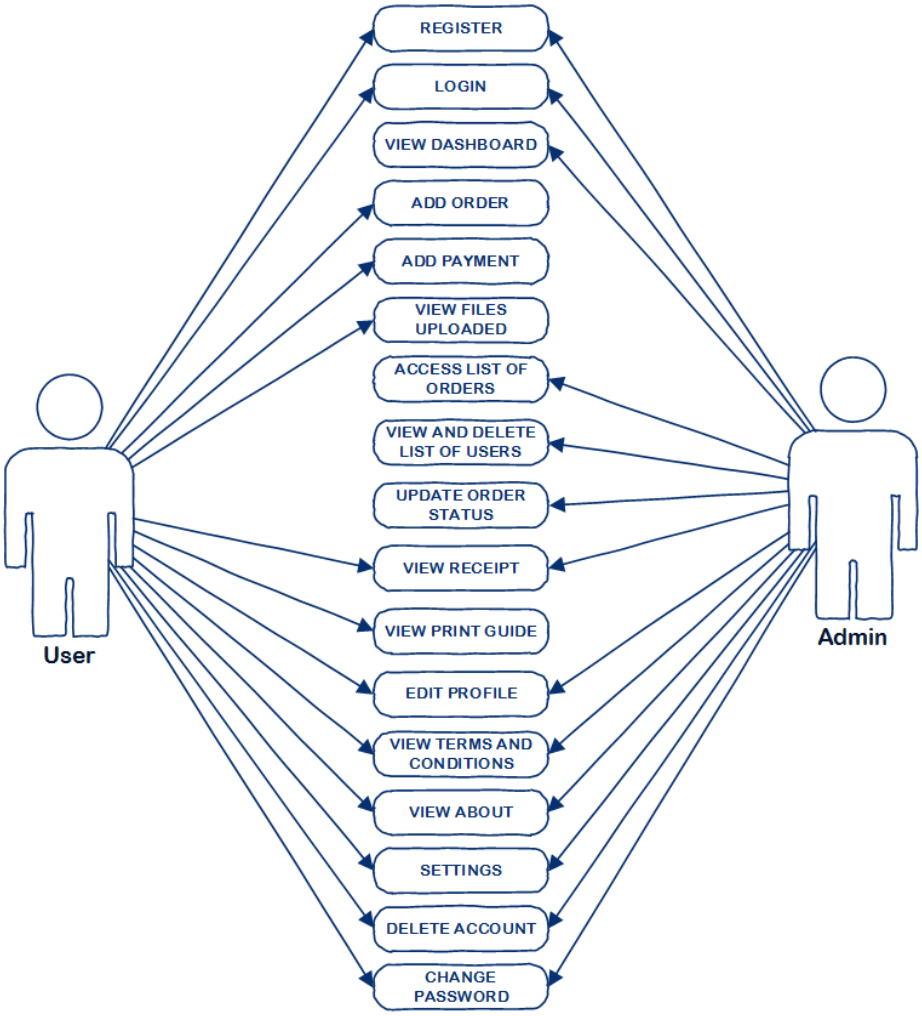

Figure 9. Use Case Diagram of the System

Figure 11 shows the use case diagram of the system. This figure describes the interaction between the two end-users and the system. It composes of two actors and 17 actions. The user actor has access to 13 actions while the admin also has access to 13 actions.

Project Development

In the development of the project, the researchers will use the System Development Life Cycle (SDLC). This will be used to suffice the needs to complete the study. The System Development Life Cycle (SDLC) model describes the stages involved in the development of the system from the beginning to the maintenance of the accomplished application. This model consists of seven (7) stages including: Planning, Analysis, Design, Development, Quality Assurance, Implementation and Maintenance.

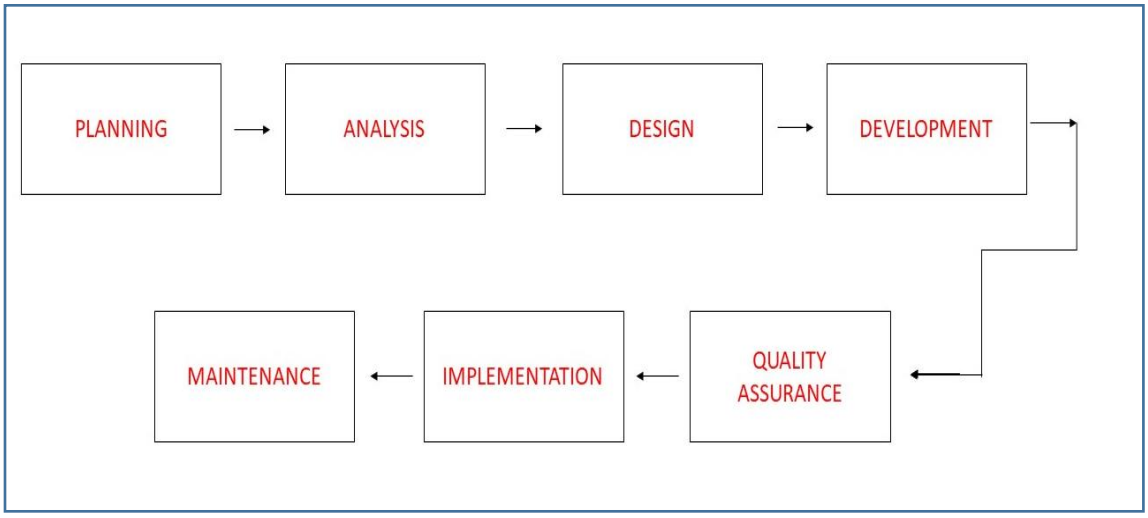

Figure 10. Project Development Stages

Figure 12 shows the stages of developing the system where it includes a step-by-step procedure namely: planning, analysis, design, development, testing, implementation and maintenance.

Description of Stages

Planning Stage – This is where the researchers conducted the colloquy to define the current problems and address the proposals for improvement. The researchers set the limitations of the study and discuss the different components that are needed to develop the project.

Analysis Stage – In this stage, the researchers evaluated the existing system. It is important that the researchers are familiar with the current situation and the demand of the printing business to develop a better project than the existing ones.

Designing Stage – The researchers needed a distinctive design that provided a solution based on the requirements and demands of the business. The design should benefit not only the students but also the administrator of the printing hub.

Development Stage – In this stage, the researchers created the application using Visual Studio Code with JavaScript Language as its programming language. The researchers used the Bootstrap, NodeJS, ExpressJS and MongoDB combination in developing the system. All the features presented in the design are presented on the completed output application.

Quality Assurance Stage – In this period, the researchers tested the complete output application. The researchers checked if the application is able to meet the standards that are set in the planning and designing stage for it to serve its main purpose. The researchers needed to test the application to assure that it is running smoothly without bugs and errors. This stage determined that the application is reliable and ready for implementation.

Implementation Stage - After checking and testing the quality of the application, the researchers implemented the system. The researchers evaluated the efficiency and acceptability of the prototype using the ISO 25010 software quality evaluation. Feedback from the users are gathered by the researchers to help them evaluate the efficiency of the system.

Maintenance Stage – After the implementation, the researchers tracked the systems performance from the feedback of the respondents/users. The systems performance are continously monitored using the information gathered from the feedback of the users. If the feedbacks are adequate, the researchers will continue to ensure that the system does not fail and is running smoothly. However, if the feedbacks are inadequate, the researchers must improve the systems performance by defining and correcting the problems and addressing the user's requirements.

Operation and Testing Procedure

To verify the accessibility and functionality of the system, different testing and operating of the system will be conducted by the client and the admin.

Operation Procedure

To operate the application, the user's device must meet the system requirements. Those are to have extra space of at least 2GB RAM and 100 megabytes of storage space.

General Operating Procedure for Users

1. Launch the web application by going to doctrack.web.app in the browser.
2. For new user, click register on the welcome page with the TUP email.
3. Read the Terms and Conditions before clicking "I Agree".
4. Once verified, login with registered account.
5. To reorder, browse from the displayed list of uploaded files and open the necessary document.
6. To order, click "Add Order" on the button above the list of uploaded file.

7. In the upload file page, input the order details such as time of pick-up, type of paper, size of paper, pages to print, page side, orientation, color, no of copies, notes and uploading the file to order.
8. To pay for the order, click “Proceed to Payment” and select between Gcash or Paymaya as payment method.
9. To complete payment, manually pay on your Gcash or Paymaya account and upload the proof of payment on the given upload image button.
10. Place order and wait for the admin to confirm the order.
11. Check order status and receipt at the list of uploaded files whether it is confirmed, prepared, rejected, and complete.
12. Browse through the print guide to see the price list and paper size guide.
13. View About module to know about Doctrack or obtain the contact information.
14. Go to settings to change password or delete account.

General Operating Procedure for Admin

1. Launch the web application by going to doctrack.web.app in the browser.
2. For new user, click register on the welcome page with the TUP email.
3. Once verified, login with registered account.
4. With the displayed list of orders, manage new orders and update the status.
5. Visit Dashboard to view the current number of customers, total sales and total income.
6. Visit list of customers to view customer information.
7. Go to settings to change password or delete account.

Functional Testing was used to check the functionality of the application including the corresponding features intended for the user and the admin.

The test case was designed and intended to gather the data from different test to examine the accessibility and effectiveness of the web system. Table 1 shows the sample test case table made to determine the functionality of the system.

Table 1

Sample Test Case Table

Test Subject	**Test Case**	**Test Procedures**	**Test Data**	**Expected Result**	**Actual Result**	**Remarks**
Client	Login Function	1. Launch the Application. 2. Enter name, password and phone number. 3. Tap "Proceed" to login as the client.	Name, Email, Phone Number and Password	Login successful as a client		
Client	Sign Up Function	1. Launch the Application. 2. Tap the "Sign Up" button. 3. Input the necessary information 4. Click "next" 5. Enter the authentication code sent to your phone and hit "submit" button.	Student Name, Mobile Number, Password, Code	Account created successfully.		
Admin	Login Function	1. Launch the Application. 2. Enter username and password. 3. Login as the admin.	Username and Password	Login successful as the admin		
Client	Edit User	1. Launch the	User Profile	Modified user		

	Profile Function	Application 2. Enter name, password and phone number. 3. Tap "Proceed" to login as the client. 4. Access "user profile" then edit the certain information. 5. Save changes.	Information	profile		
Client	Attach File Function	1. Launch the Application. 2. Enter name and phone number. 3. Tap "Proceed" to login as the client. 4. Tap "Upload File" and select any PDF file.	Attach PDF File	File successfully attached		
Client	Button Function	1. Launch the Application. 2. Enter name, password and phone number. 3. Tap "Proceed" to login as the client. 4. Tap "Upload File" and select any PDF file. 5. Select time for pick-up and add notes/instructions to the admin. 6. Select the type of paper, enter number of copies and select print color.	Time, Paper, Finish, Copies and Note	Buttons are working depending on their function.		
Client	Payment Function	1. Launch the Application. 2. Enter name and phone number.	Payment method	Access and pay successfully via Paymaya		

		3. Tap "Proceed" to login as the client. 4. Tap "Upload File" and select any PDF file. 5. Select time for pick-up and add notes/instructions to the admin. 6. Select the type of paper, enter number of copies and select print color. 7. Choose payment method: Paymaya or GCash.		or GCash.		
Admin	Record and Transaction Function	1. Launch the Application. 2. Enter username and password. 3. Login as the admin. 4. Access "Printing History".	Transaction History	Lists were successfully shown along with the payment.		

The researchers will identify the test case problems present in the in the mobile application as follows:

- **Test Subject -** Specific user that has accessed and operated the system
- **Test Case -** Function and features that are being tested in the system.
- **Test Procedures -** Number of steps to check and evaluate the test cases in the system.
- **Test Data -** Information that the test case requires.
- **Expected Result -** The expected outcome of testing the system's functionality.
- **Actual Result -** The actual outcome of testing the system's functionality.

- **Remarks -** Field for comments, feedbacks and suggestions.

Accuracy Testing to identify possible problems and error occur while using the application in terms of file transfer specifically in sending and receiving of file along with the client and admin.

Table 2

Accuracy Test Table

No.	Test Subject	Test Case	Problem/Error Assessment	Priority Level
1	Client	Sending File		
2	Admin	Receiving File		

The researchers will identify the test case problems present in the in the mobile application as follows:

- **Test Subject** - Specific user that has accessed and operated the system.
- **Test Case** - Sending or Receiving File that is being tested in the system.
- **Problem/Error Assessment** - Description of the identified problem or error present on file transfer in the system.
- **Priority Level** - An order of priority to the defect found in the system. Classified into three types: low, medium and low

The researchers will gather all the data based on the test cases conducted and assess the different issues encountered. Documentation will be done along with the recorded information to the mobile application usability.

Implementation Plan

The implementation strategy will be separated into parts. The first step is to emphasize preparing the correct methods between the proprietor and the provider. It starts within thorough pre-shared devising, in which the provider with proper documents and an implementation environment is offered and established. Next is to fine-tune all the specific settings with the assistance of our mentor. Once the setup is complete, it is important to test each function and check for system issues or defects. Additional modification accompanies, such as troubleshooting application. Finally, the current circumstances and the eventual state may be outlined and compared. Researchers will compare the end state to the intended state, which was initially sought to attain, and if it fulfills all of the intended qualities, such as functionality, safety, and so on, then it can be switched to the real operation.

Technicians must conduct proper training to operators or workers prior to launching the system application. Lastly, the implementation period is the conclusion of optimum performance, after which the task is completed.

Implementation Schedule

TASK	% DONE	ASSIGNED TO	TASK DURATION	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5	WEEK 6	WEEK 7	WEEK 8	WEEK 9	WEEK 10
Project Start-Up	100%	Project Manager	3										
Current state analysis	100%	Project Manager	4										
Create a proposal	100%	Project Manager	7										
Financial analysis and research	30%	Project Manager	4										
Vendor selection	0%	Business Sponsor	3										
Preparation before implementation	0%	Quality Assurance Manager	7										
Security system implementation	0%	Security Officer	5										
Additional settings	0%	System Developer	2										
Test operation	0%	System Developer & Configuration Management Manager	4										
Troubleshooting control	0%	Database Administrator	3										
Training courses	0%	Site implementation Representative	7										
Troubleshooting control	0%	Database Administrator	7										
Closure of project reserve	0%	Project Manager	14										

Figure 11. Gantt Chart of the initial intended project timeframe

The following is the anticipated timetable:

- Project Beginning- Week 1
- Analyzing current circumstances- Week 1
- Developing an effective design model- Week 2
- Marketing study and Financial planning- Week 3
- Selection of suppliers- Week 3
- Construction preparatory implementation- Week 4
- Execution + Supplemental settings- Week 5
- Test run + Troubleshooting- Week 6
- Training- Week 7
- System start-up + Troubleshooting- Week 8
- Finalization of the project + Reserve- Week 9-10

The project's maximum length was set at 70 working days. The first operation will take the shortest time. A two-week reserve has been established aside to help stabilize the new system's function.

It is required to build a place in which every procedure can occur before the supplier's execution. It is crucial to construct a digital reality or host to execute all the needed to complete the printing system application. The server requirements are nothing out of ordinary, consisting of simply most basic characteristics. Although this process

necessitates the development of an internal application, it must be localized within the institution. As a result, this operation must allocate the sufficient area for implementation.

Data Security and Privacy Issues

Printing security prevents the user or client from unexpected printing to equipment that wasn't previously permitted, even if the user had already configured to other system printers. The entire data is secured, even its client host printer connection or viewing printer system information.

Once the printed papers are ready, an individual might fail to remember to collect the documents, or someone who printed before or after them may take them. The new method also allows for repeated printing. The new method also allows for repeated printing. The user installs the program, and earlier documents that aren't required to deliver before every print instead stays in the program and, some moment throughout device operation, could be printed.

Moreover, the client against scanned data capture is protected since it automatically notifies the sender that accessed the printer when the paper is received. Under these conditions, the responder quickly recognizes the culprit of the error. Consequently, the printer is prevented from unwanted system access. Outsiders or workers who do not have a personal account or the login code are unable to execute any actions on the printer. Anonymous copying actions on unattended printers will be eliminated as a result of this. Furthermore, when changing materials, the printer is prevented from unwanted intrusion.

An administrator password protects the printer during a physical assessment, which provides accessibility to complex configurations and extensive research. Toner inputs are also guarded in a secure location that can only be accessed when an administrator has been

authorized. Although the notification setup is installed and configured, it is unnecessary to indicate reduced consumable quantities since it will replicate toner substitute needs.

So the helpdesk department is in charge of printing and system administration, it is up to them whether or not to employ secure access. The system may manage the printer without the use of passwords or identification. The option of activating the secure printer mode on small printers doesn't need a user authentication and instantly produces documents as fast as could be expected. Otherwise, the strategy for using small or medium equipment is safe. Printers, for instance, are located immediately at a workplace or in private agencies in which produced papers could get hold of anyone that doesn't represent a risk of confidential data leaking. Most printers against unauthorized acts like altering configurations or delivering emails to another receiver bases are likewise protected. Besides, this sort of printer by the system is managed and checked regularly. It tracks the proportion of documents produced per individual or set defined in the system based on departments, floors, or partition settings.

Staff Implementation Training

The final phase in the implementation process is to record the procedure and educate the staff. The System Management Technical Department will obtain the training delivery material. Since the system's functionality is low, a single technician can operate it. To assure substitutability, therefore, everyone will participate.

Table 3

Distributor provided training content

DocTrack simple setup: performance monitoring, database aid and improvement
Client 1st segment < DocTrack app configuration < admin

Client 2nd segment < DocTrack app configuration < user
Print apparatus < examine and record
Printing profession and progression < decisiveness
Integrated fixed interface < setup, deployment and deactivation
Examine profile < account making and design layout
Assigning rules and registrations
Creating and writing reports
Reporting incidents and troubleshooting

All of these phases were addressed throughout the deployment or through further settings. However, other technicians must regulate them in order to represent them at the start of difficulties. To minimize unwanted errors when using or modifying the system, it is advised that technicians should be given authority, with the chief technician remaining in charge and other work tasks delegated to other technicians. An employee or technician can exclusively assign access control codes or make reports or even check supply conditions without changing any network setup, either for workstations or web applications. Hence, inexperienced helpdesk personnel can be assigned to simple access rights while preserving substantial substitutability in the absence of technicians.

Implementation Impact

When modifying current infrastructure, this is essential to identify the previous data and discover appropriate approaches to create the latest and shift between one network to another. Thus, the initial process is to construct a thorough evaluation that specifies the existing situation to determine the best option. A variety of new challenges must be faced and handled while introducing new systems. One of the disadvantages might be the new

system's impact on personnel. Employees may be resistant to different methods for many purposes. It is essential to consider how people are aware of adjustments, adapt to changing processes, and show the advantages to the organization and individuals.

One technician manages to provide printer assistance through the new system's installation. The forced use of network printers and the restrained reduction of small local printer usage have decreased because of repeated print mistakes. System printers employ great ability print toners, which outperform small toners. The following report is prepared to restore and the toner the next day; instead of a massive workload on the same day, the toner adjustment condition is fixed and recorded. The technician responds relatively quickly before a report whenever a misfeed or even another defect. If a fault like jammed sheets is detected, the issue is solved just before the client files a complaint. The typical user error concern is improperly placed sheets on a tray, such as an A4 inserted on the tray A3 produces print failure on the feeder. Forgotten device resources are nullified, such as printed documents or USB malware attacks.

Unresolved needs to the print supplier assign technical difficulties or system vendor DocTrack problems by the Technical Department.

Deployment Procedure

Week 1 was designated as the commencement of the project, while Weeks 9-10 was designated as working weeks. The basis regarding discussions on monitoring would be examined and planned throughout these weeks. The following resort includes personal experiences about the present system's operation, surroundings, and functionality. The supplied documents served as the foundation for the creation of a new solution are based

on that observation and discussion with authorized personnel. The next point will accomplish the following day, accompanying a spare to the following day to present organizational options. Evaluation will continuously perform. Once the suggested model has been authorized, the solution step may begin. Week 4 will be the start of the preparations for the new system's deployment. There will be one week set up for the procedures. Because the supply of the new printer during the adoption of the developed application is not required, a one-week finishing date is established for the provider to supply and function the existing new-acquired printer.

The recently acquired printer will be operational for no more than one week. After completing the preparations, the new system's implementation phase could begin with one week allotted for installing and setting up old print machines.

The experimental procedure will begin in week 6 with a one-week run. Before this phase, it is vital to notify those currently utilized supplied printers to modify and offer more details on the developed program. A Bug Fixing and Control will commence at this period. This stage is to modify the print equipment and computer configurations or gather information problems to give clients responses to its inquiries and execute consecutively. During this point, a feedback form is to notify another employee once the operation is complete. Following the completion of the test operation, some service desk personnel should acquire the required instruction to run the developed program. Afterward, it may continue to the whole operation's final and significant essential step when the teaching process is acquired. Workers will be notified about the following procedures before initiating and will receive prepared responses to inquiries and instruction manuals for utilizing the system. The observer monitors the employee's output and queries during the

operation. After one week of the process without severe defects and the procedures are followed, the phase of inadequacies and project is completed and can be terminate.

The final check is significant, so examining before submitting the project ensures that the scope statement has reached the post parameters. The plan should have accomplished the different parts of the objectives.

Evaluation Procedure

Conducting of the system application will be checked and analyzed to determine if the objectives were attained. For this method, the ISO/IEC 25010 software evaluation form is intended to utilize the assessment criterion to measure the performance of the system, as shown in Appendix A.

The following are the criteria that will be used in evaluating the system:

- **Generality-** the capacity of a system to be employed with a wide variety of similar issues is assessed in terms of generality. The scope of the settings in which a system may be anticipated to perform is referred to as its generality.

- **Adaptability-** it evaluates the system's ability to modify a specific user's needs and potential for further growth and use. In addition, the program has to be adaptive to various occupational settings and interface within current or application programs.

- **Compatibility-** assessments are needed to determine whether the developed program did not incorporate the existing system's capabilities and utilized planned methods. To put it in another way, it searches for system incompatibilities.

- **Visual Interaction-** also known as the GUI. It determines by assessing the system's user-friendliness and how an individual user engages with it. The interface's readability and usefulness are needed to be analyzed.

- **Usefulness-** the usefulness of the knowledge base will demonstrate by ensuring that it has the relevant and suitable variables and relations for utilizing the analytical domain.

- **Help information-** it should be adequate to allow a new client to operate the network. A constructed assessment is needed to yield assistance knowledge that analyzes sufficient precision and clarity.

- **Security testing-** tests are needed to seek to compromise the system's security, such as unauthorized users accessing a database.

- **Maintenance-** a program will establish particular requirement needs; for example, updates of a certain degree of sophistication must require not much more than a given duration.

- **Storage-** proper storage requirements, including a total limit of primary or backup memory capacity, require the development of tests that identify occurrences whenever the program reaches the maximum limits, for example, encoding or similarly producing a significant volume of information to capacity assessments.

- **Convenience-** the simplicity of use or interoperability within the current system plays a critical role in developing and utilizing the working prototype.

For the gathering and analysis of evaluation data, the following procedures are to conduct:

1. Participants are expected to query that the system used for the hypothetical experiences and to provide comments on their experience.
2. The purpose of the test was to expose the prototype system to critique and to highlight the issues experienced by the user.
3. The evaluation results will be summarized and examined for future discussion.

Table 4

Likert Scale System

Numerical Scale	Equivalent Descriptive Rating
5.0	Outstanding
4.0	Very Satisfactory
3.0	Satisfactory
2.0	Fair
1.0	Poor

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Appendix A

SYSTEM EVALUATION INSTRUMENT

Name (Optional):

_____

Instructions: Please complete the following evaluation form for the system application on the given scale by putting an X mark under the corresponding numerical rating as 4 is the highest and 1 is the lowest. Your feedback is important for planning future programming; continual improvement and suggestions will be considered.

CRITERIA		PERSPECTIVE	RATING			
			4	3	2	1
1. Functional Sustainability	a. Completeness	Functions covered all the specified tasks of the application.				
	b. Correctness	Functions output in testing and implementation has correct results.				
	c. Appropriateness	Functions facilitate the accomplishments of specified tasks.				
2. Efficiency/ Performance	a. Time Behavior	Functions meet the required time to complete the task.				
	b. Resource Utilization	Functions meet the required use of resources to complete the task.				
	c. Capacity	Functions meet the system's required parameters.				
3. Compatibility	a. Co-existence	A software product can perform specified functions without negatively impacting other software products inside the system.				
	b. Interoperability	A software product can exchange and use information with other software products inside the system.				

4. Usability	a. Appropriateness Recognizability	Users can determine if the software product is appropriate for their needs.				
	b. Learnability	Specific users can learn software products.				
	c. Operability	The software product can be learned and controlled easily.				
	d. User error protection	Software product protects users from making mistakes in handling the product.				
	e. User interface aesthetics	User interface of the software product enables satisfaction for the user.				
	f. Accessibility	The product can utilize by the vast majority of users with a wide range of characteristics.				
5. Reliability	a. Maturity	The software product meets the reliability requirements while under operation.				
	b. Availability	The software product is accessible when required for use.				
	c. The fault tolerance	The software product still operates as intended, even under hardware or software failure.				
	d. Recoverability	The software product has the capability of recovering data in the event of unexpected failure.				
6. Security	a. Confidentiality	The software product ensures that registered users may retrieve data from the system.				
	b. Integrity	The software product denies unauthorized users from accessing the data or program from the system.				
	c. Non-repudiation	A software product can prove that such events or actions from				

		the user have taken place.				
	d. Accountability	A software product can trace an action by a user to the correct user.				
	e. Authenticity	The identity of a specified user is proven.				
7. Maintainability	a. Modularity	A software product is composed of distinct components, so changing one has a more negligible effect on the others.				
	b. Reusability	Software product assets utilize on more than one system.				
	c. Analyzability	While the software is under operation, it allows for the analysis of modifications or failures.				
	d. Modifiability	The software product modifies without degrading the quality of operation.				
	e. Testability	Effectiveness and efficiency of which test criteria established for a system.				
8. Portability	a. Adaptability	A software product is effectively adept into newer hardware or platform.				
	b. Installability	The software product is easily installed or uninstalled in a system.				
	c. Replaceability	A software product can replace another specified software product with the same purpose.				

Comments / Suggestions:

_____

_____

Signature: _____ Date:_____

Appendix B

GANTT CHART

TASK	% DONE	ASSIGNED TO	TASK DURATION	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5	WEEK 6	WEEK 7	WEEK 8	WEEK 9	WEEK 10
Project Start-Up	100%	Project Manager	3										
Current state analysis	100%	Project Manager	4										
Create a proposal	100%	Project Manager	7										
Financial analysis and research	30%	Project Manager	4										
Vendor selection	0%	Business Sponsor	3										
Preparation before implementation	0%	Quality Assurance Manager	7										
Security system implementation	0%	Security Officer	5										
Additional settings	0%	System Developer	2										
Test operation	0%	System Developer & Configuration Management Manager	4										
Trouble shooting and control	0%	Database Administrator	3										
Training courses	0%	Site Implementation Representative	7										
Trouble shooting and control	0%	Database Administrator	7										
Closure of project and reserve	0%	Project Manager	14										

RESEARCHER'S PROFILE

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WORK EXPERIENCES

- Production Area, Creotec Work Immersion (STEM) February 2018
  CREOTEC Philippines Inc. – Manila Center
  4th and 5th Floors, Doña Felisa Syjuco Bldg., Remedios St., Taft Ave, Malate, Manila, Metro Manila

EDUCATIONAL BACKGROUND

- Bachelor of Engineering Technology in Computer Engineering Technology
  2018–Present
  Technological University of the Philippines

- Senior High School 2016–2018
  Woodridge College

- Junior High School 2014–2016
  Woodridge College

- Junior High School 2012–2014
  St. Dominic College of Asia

- Elementary 2006–2012
  St. Thomas More Academy

RESEARCHES CONDUCTED

- Title of Research: "Teachers' Attitude and Behaviour on Dealing with Cyber Bullying"

- Title of Research: "Let There Be Light: Adding Power To The House"

CONFERENCES/ SEMINARS/ TRAININGS ATTENDED

- Building Academic Integrity using Turnitin March 25, 2021
  Office of the Vice President for Research and Extension
  College of Industrial Technology, Technological University of the Philippines

- Introduction to The Internet of Things February 18, 2021
  Trend Micro Secure Learning
  Trend Micro, Inc.

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WORK EXPERIENCES

- Work Immersion at José Rizal University – Mandaluyong 2017-2018

EDUCATIONAL BACKGROUND

- Bachelor of Engineering Technology
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  Technological University of the Philippines

- Science, Technology, Engineering, and Mathematics (STEM) 2016 - 2018
  José Rizal University – Mandaluyong

- High School
  Regina Apostolorum Academy 2013 – 2016

- Elementary
  Tomas Earnshaw Elementary School 2006 – 2012

CONFERENCES/ SEMINARS/ TRAININGS ATTENDED

- "Building Academic Integrity Using Turnitin" March 25, 2021
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- "Introduction of The Internet of Things" February 18, 2021
  Presented by Donnie Celestre – TREND MICRO
  Technological University of the Philippines

- "First Aid CWATS Seminar" October 6, 2019
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MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS

- 2BITS MEMBER TUP-Manila

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WORK EXPERIENCES

- Work Immersion in Architecture Technology Department — February 2018
  Zamboanga City State Polytechnic College
  R.T. Lim Boulevard, Zamboanga City

EDUCATIONAL BACKGROUND

- Bachelor of Engineering Technology — 2018–Present
  Major in Computer Engineering Technology
  Technological University of the Philippines

- Senior High School — 2016–2018
  Immaculate Conception Archdiocesan School

- Junior High School
  Bethany Child Development Center — 2015–2016

- Junior High School
  Zamboanga Avalokitesvara School — 2012–2015

- Elementary — 2011–2012
  Zamboanga Avalokitesvara School

- Elementary — 2006–2011
  Tetuan Central School

RESEARCHES CONDUCTED

- Title of Research: "The Influence of Gadgets Addiction in Student's Academic Performance of Senior High School Students in Immaculate Conception Archdiocesan School."

- Title of Research: "Awareness of Intermediate and High School Students of Bethany Child Development Center on Proper Waste Disposal"

CONFERENCES/ SEMINARS/ TRAININGS ATTENDED

- Building Academic Integrity using Turnitin — March 25, 2021
  Office of the Vice President for Research and Extension
  College of Industrial Technology, Technological University of the Philippines

- Introduction to The Internet of Things — February 18, 2021

Trend Micro Secure Learning
Trend Micro, Inc.

- Introduction to AutoDesk TinkerCad May 13, 2020

MechaniWeb
AutoDesk Authorized Academic Partner

- First Aid Seminar CWTS October 6, 2019

Technological University of the Philippines

MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS

- 1O Bits Organization (Member)
- ZAS Lotus Editorial Staff (Member)
- ZAS Journalism Club (Cartoonist)
- ZAS Performing Arts Club (Member)

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- Bachelor of Engineering Technology
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- Science, Technology, Engineering, and Mathematics (STEM) — 2016 - 2018
  Manila Tytana Colleges – Pasay

- St. Alphonsus Liguori Integrated School — 2010 - 2016

- St. John Bosco — 2006 - 2010

RESEARCHES CONDUCTED

- Development of DOCTRACK: A Mobile Printing Application Software

- Anxiety Unraveler: A Cranical Electrotherapy Stimulation Device for Anxiety

- Saltwater as an Alternative Source of Energy

CONFERENCES/ SEMINARS/ TRAININGS ATTENDED

- "Building Academic Integrity Using Turnitin" — March 25, 2021
  Technological University of the Philippines

- "Introduction of The Internet of Things" — February 18, 2021
  Presented by Donnie Celestre – TREND MICRO
  Technological University of the Philippines

- First Aid Seminar CWTS — October 6, 2019
  Technological University of the Philippines

MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS

- TUP DUGONG BUGHAW (Member)
- SALIS SPORTS CLUB (Member)
- SALIS EARTH SAVERS CLUB (Member)
- SALIS READING CLUB (Member)
- SALIS MUSIC CLUB (Member)

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WORK EXPERIENCES

On the Job Training:

- Work Immersion in Bambu Wireless
  Century City Lifestyle Center, Poblacion, Makati City

- Work Immersion in Topserve Service Solutions Inc.
  Pres. Osmena Avenue, Bangkal, Makati

EDUCATIONAL BACKGROUND

- Bachelor of Engineering Technology
  Major in Computer Engineering Technology 2018 - Present
  Technological University of the Philippines

- Science, Technology, Engineering, and Mathematics (STEM) 2016 - 2018
  Paco Catholic School

- Paco Catholic School 2006 - 2016

RESEARCHES CONDUCTED

- Proving the Feasibility of Household PET Water Pipes made from PET Plastic Bottles by Comparing it to Household PVC Water Pipes
- The feasibility of growing plants using hydroponics with nutrient solution from vegetable waste.

CONFERENCES/ SEMINARS/ TRAININGS ATTENDED

- "Building Academic Integrity Using Turnitin" March 25, 2021
  Technological University of the Philippines

- "Introduction of The Internet of Things" February 18, 2021
  Presented by Donnie Celestre – TREND MICRO
  Technological University of the Philippines

- First Aid Seminar CWTS October 6 2019
  Technological University of the Philippines

- Leadership Training September 2016
  Paco Catholic School

- Drug Awareness and Prevention Seminar
  November 2016
  Paco Catholic School

- Career and Employment Seminar December 2015
  Paco Catholic School

MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS

- 1O Bits Organization (Member)

- PCS Dynamic Thinker's Club (Secretary)