Smart Printing Management System Using Structured Analysis

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ABSTRACT

The Smart Printing Management System is an online printing ordering system. The purpose of developing this system is to take online printing orders in a much more efficient way from the customer so that the customer does not have to wait for a long time at the shop to print up their stuff. The system also provides printing templates design for each category of printings so that the customer can customize their own printing designs before they upload their material to order. The system also will manage the daily printing sales record from the customer which is the daily printing sales report will be saved in the system so that the shop will have proper records of the customer's sales every day. They can also view the daily printing sales report in a graph form where it will be easier to evaluate their daily sales. Moreover, the system also will manage the product stock as well which is the system will display "low stock" for the quantity of the product stock is less than 10. So the shop can know which the specific number of the item is currently available for the customer to purchase. Moreover, the admin also can add and edit the product stock whenever needed. Furthermore, this system also helps the shop to avoid product overstock and outages. The methodology that use to develop this system is the waterfall model.

## 1.	Introduction

Printing shop is an essential shop at every place, especially if there is a University or schools are located nearby. Usually most of the students often come to the printing shops to print their notes, reports and etc. However, sometimes, due to the less efficient, printing shops have a problem with their daily printings and also with their sales and product stock account management as well [1]. The customers also have trouble in sending their printing materials because they have to wait too long in a queue at the shop to make their orders. Thus, a system named "Smart Printing Management System" should develop to help both customers and as well as the printing shop.

To run the system, a client is selected, which is "Chiteera Printingshop" located in Taman Sejahtera, Kulim Kedah. Smart printing management system is an online printing ordering system. The system also will manage the daily printing sales report and also will manage product stock handling as well. There are three main reasons to build this system, first is to take online printing orders in a much more efficient way from the customers. Moreover, the shop provides various kind of printing such as banner printing, sticker printing, business card printing and much more.

The second reason is to manage the daily printing sales report from the customer. The system will also manage the printing sales reports. It means their printing sales report will be saved in the system so that the shop will have proper records of the customer's sales every day in which can also view their printing sales report in a graph form where it will be easier to evaluate their daily printing sales. The third reason is the system also will support the product stock handling as well. It means the system will display "low stock" to the shop for an item that is low in stock. So the shop can know

which the specific number of the item is currently available for the customer to purchase. Moreover, the admin also can add and edit the product stock whenever needed. Furthermore, this system also helps the shop to avoid product overstock and outages. The objective of the project is as stated as below:

1. To design a smart printing management system.

2. To develop an online printing ordering system.

3. To analyze daily printing sales report and also will manage product stock handling.

The rest of the paper is organized as follows: Section II describes areas of studies and reviews from similar systems. Section III presents the methodology used to develop the Smart Printing Management System which is the Waterfall Process Model. Section IV shows the result of system analysis and design. Section V shows the system implementation and testing and section VI is the conclusion.

2.   Literature Review

In order to understand more about the printing systems concept and current trends, here are the highlighted area of studies as follows:

2.1   Printing

Printing is a process for reproducing text and images using a master form or template. The earliest non-paper products involving printing include cylinder seals and objects such as the Cyrus Cylinder and the Cylinders of Nabonidus. The earliest known form of printing as applied to paper was woodblock printing, which is appeared in China. Later the developments in the printing technology include the movable type is invented by Bi Sheng and the printing press invented by Johannes Gutenberg in the 15th century [6]. The technology of printing played a key role in the development of the Renaissance and the scientific revolution and laid the material basis for the modern knowledge-based economy and the spread of learning to the masses.

2.2   Ordering System

The Ordering system is the system that stores the data about an order from the customer services employees or customer directly [2, 3]. The data will be stored in the database and send the order information to the processing department. Order system provides tracking data on order and inventory. Order system provides updates about the inventory information, vendor's database, customer's database, returns and refunds, information on payments, order processing records and other general information. By using the inventory information and the vendor's database, the system will store the data for all the inventory information and purchasing data. Besides, if the staff made the mistake during the processing, the customer can return or refunds their purchasing. All the payment will be records and store. Therefore, by using the order system, the company data arranged accordingly. The advantages of the order system are it can improve sales visibility, customer relations and efficient order processing with a minimum delay and back-order.

2.3   Product Stock Control System

In one sentence product stock is nothing but it will give uninterrupted service towards the production, sales, maintenance and much more with minimum stock [7]. Product stock control can be broadly defined as "the act of checking a shop's stock". Stock control is also about knowing where all the stock and ensuring everything is accounted for at any given time. A Product stock control system is a process for managing and locating objects or materials. In common usage, the term may also refer to just the software components. Many shops now use stock control systems. The term "stock control system" can be used to include various aspects of controlling the amount of stock on the shelves and in the stockroom and how reordering happens. Typical features of stock control software include ensuring that the products are on the shelf in shops in just right quantity. The system capture data when a customer buy a product and it will also automatically give notification when more product needs to be put on the shelf from the stockroom.

The study on the existing system will able to identify the deficiencies and advantages of each system that we are studied. There are three existing systems that are reviewed which are CopyCopy, OnlinePrinters, and VistaPrint. Figure 1 shows CopyCopy Online Design Print User Interface. CopyCopy is a local online print shop with high-quality printing and creative design services, including brochures, posters, business card design and much more. The customer can place their printing orders online as well and also can customize their own printing design. The system also provides a wide range of services from high volume copies, color copies, blueprints, wide format printing, and scanning. Furthermore, for those special print projects, they offer a full range of bindery services including cutting, folding, scoring, and creasing. Once the customer makes their order they can get their order within 24 hours. The customer can take their orders at the shop and make their payment or the customer can get their order via shipping.
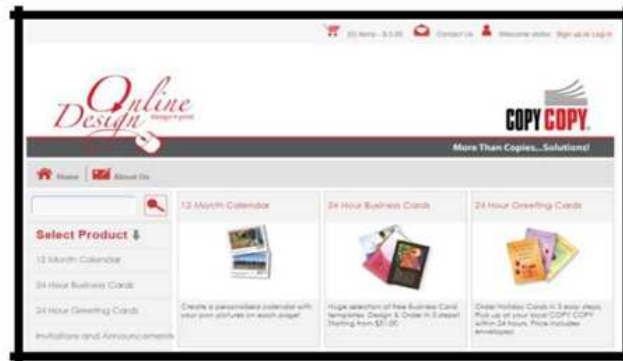

Figure 1. CopyCopy User Interface

Online Printers, is an online printing ordering system. The system provided a large variety of printings materials such as flyers & leaflets, postcards, folders, brochures, posters, letterheads, business cards, catalogs, advertising systems, and much more, are available in high-quality offset and brilliant digital printing quality. Other than that the Online Printers also sell other products such as stationaries. The customer can create their own print file at the website and save their file and then submit these file for print. Once the printing is ready the Online Printers will have shipped the printing orders to their customer itself. Figure 2 Shows the Online Printers User Interface.
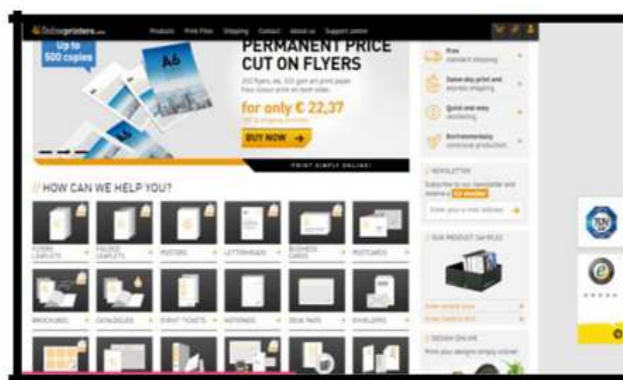

Figure 2. Online Printers User Interface

Vistaprint is an online printing system and also able to advertise other printing company materials as well. The Vistaprint also provide a wide range of quality products and affordable prices, along with design tools suited to every skill level and needs, mean everyone can create the customized materials they need to get their message across. The Vistaprint promote a wide range of all categories of printed materials on their website. The customer can design their printing orders with their own creativity by given templates before they make their orders. Other than printing material they also provide other category product to sell such as clothing's, bags and stationaries. Figure 3 shows the user interface of VistaPrint.

Figure 3. VistaPrint User Interface

Table 1 shows the comparison from reviews of similar systems, and also have identified the architecture and requirements as well as flaws that can be improved during the development of the Smart Printing Management System.

Table 1. Comparison between similar existing systems

Description	CopyCopy	OnlinePrinters	Vistaprint	Smart Printing Management System
Online system	yes	yes	yes	yes
interface	Easy to understand and interesting	The content is well defining and organize with the correct navigation and labelling system and easy to understand	Not easy to understand and interesting and content are not well define with proper labelling system	Will be well define and organize with the proper labelling system and easy to understand
Registration module	yes	yes	yes	yes
Login module	yes	yes	yes	yes
Order module	yes	yes	yes	Yes
Download printing template	yes	no	no	yes
Sales report module	no	no	no	Yes
User management module	no	no	no	Yes
Product stock module	no	no	no	yes

3. Methodology

The process model used to develop the Smart Printing Management System is a Waterfall Process Model. This process model is selected because the requirements gathered are clear and specific [4]. This methodology consists of five phases: planning phase, analysis phase, design phase, implementation phase, and the testing phase [5]. Figure 4 shows the five phases of the waterfall

process model. The phases of this waterfall process model are interrelated in which the result of the first phase related to the second phase and so on until the final phase of the testing. The first phase should be completed before moving to the next phase. In addition, the waterfall process model is also easily monitored since the beginning and the end of a phase has a structure and format that is clear. Description of the process workflow is explained in Table 2.
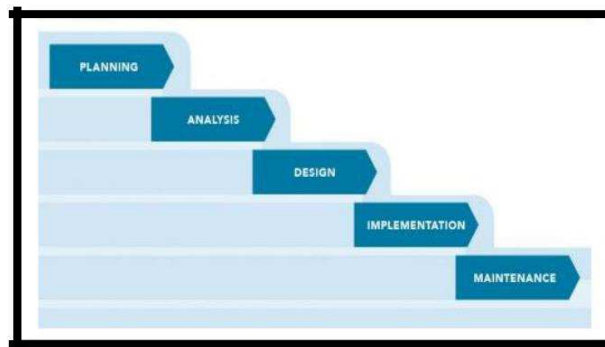

Figure 4. Waterfall Model Process

Table 2. Waterfall Process Workflow

Phases	Purpose	Deliverables
Planning	The collection of information about the organization, and the Gantt Chart is set to plan the timeframe taken to develop the system.	▪ Additional project specification ▪ Gantt chart
Analysis	Make interviews, questionnaires and literature review.	Interviews and questionnaires
Design	Design related diagrams to refer when developed system.	CD, DFD Level 0, DFD Level 1, ERD, Data Dictionary and Wireframe
Implementation	The coding activities that focus on the PHP languages which used for online based system. In this phase interface will be designed to be implemented in the system.	User Interface and Database
Maintenance	Evaluation for the system is use to give rating, comment, and feedback. These will be use to improve the system. Then, data testing is implemented.	

4.   System Analysis and Design

This chapter discusses the analysis of system requirements and designs for the development of the Smart Printing Management System. Among the model designs used are Context Diagram, Entity Relationship Diagram, and FlowChart. Each design produced describes the system development process with information and data stored in the system database.

4.1   FlowChart

A flowchart is a formalized graphic representation of a logic sequence, work process, organization chart, or similar formalized structure [8]. The purpose of a flowchart is to provide people with a common language or reference point when dealing with a project or process. Flowcharts use simple geometric symbols and arrows to define relationships. Figure 5 shows the Administrator flowchart.
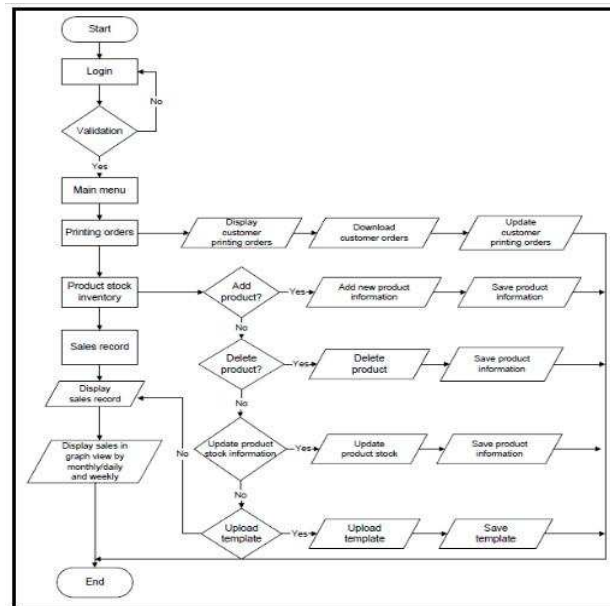
Figure 5. Administrator flowchart

4.2   Context Diagram

A system context diagram (SCD) in engineering is a diagram that defines the boundary between the system or part of a system, and its environment, showing the entities that interact with it. This diagram is a high-level view of a system. It is similar to a block diagram [9]. The context diagram is a graphical sketch that shows the interrelated relationship between the modules, the relationships of external entities that are significantly associated with the process of developing Smart Printing Management System. A context diagram is used to indicate the relevance of the system. Figure 6 shows the context diagram for the proposed system.
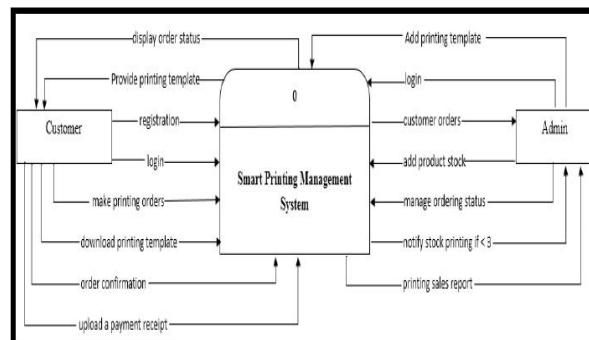
Figure 6. Context Diagram

4.3   Data Flow Diagram Level 0

In Data Flow Diagram Level 0, all the processes are illustrated in a higher level of detail. In Smart Printing Management System there are six processes behind the system. Figure 7 shows the Data Flow Diagram Level 0 for the system.
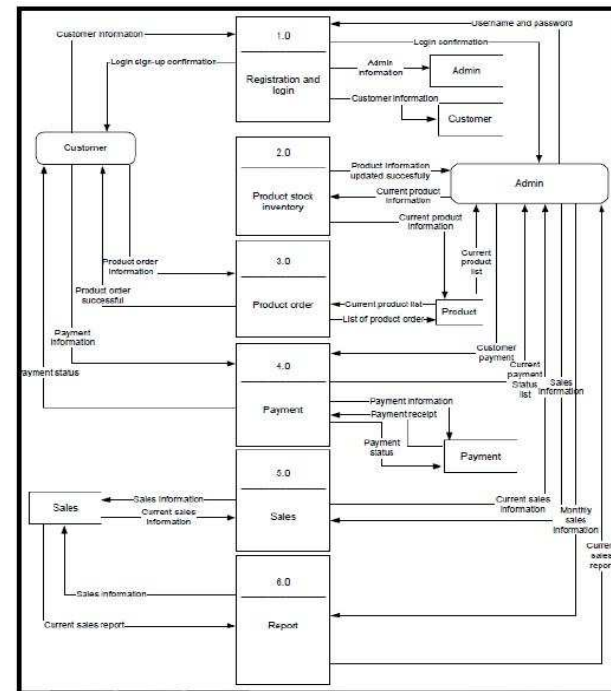
Figure 7. Data flow Diagram Level 0

4.4   Entity Relationship Diagram

An entity-relationship model also called an entity-relationship (ER) diagram, is a graphical representation of entities and their relationships to each other, typically used in computing in regard to the organization of data within databases or information systems [10]. An entity is a piece of data-an object or concept about which data is stored. Figure 8 shows the Entity Relationship Diagram for the system.
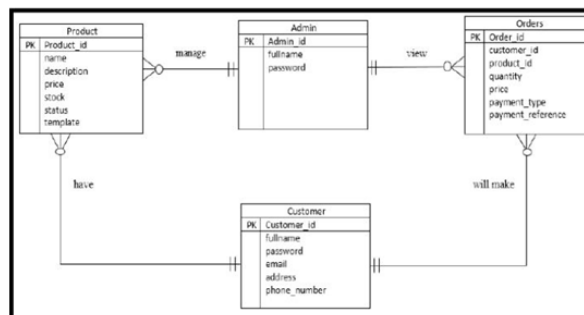

Figure 8. Entity Relationship Diagram

4.5   Data Dictionary

A data dictionary usually contains a list of all files in the database, the number of records in each file, and the names and types of each field. Most database management systems keep the data dictionary hidden from users to prevent them from accidentally destroying its contents. Data dictionaries do not contain any actual data from the database, only bookkeeping information for managing it. Without a data dictionary, a database management system cannot access data from the database.

4.6   User Interface Design

To create an intuitive and user-friendly interface, aspects like layout, navigations, colour schemes and forms elements were planned carefully. In Smart Printing Management System, the values functional design, minimalist design, and flat design in order to provide the user with simple yet rich with the user experience. Figure 9 until Figure 11 show the wireframe for the proposed project.
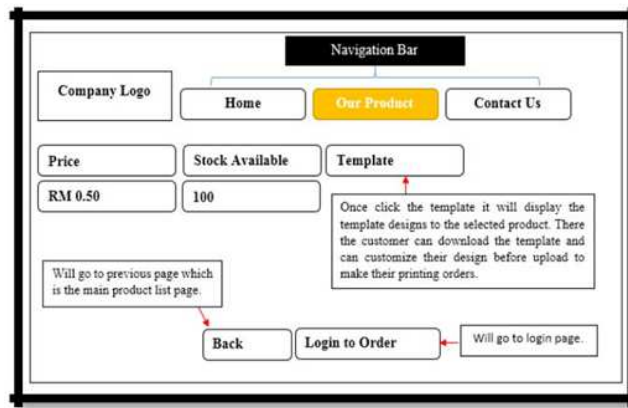
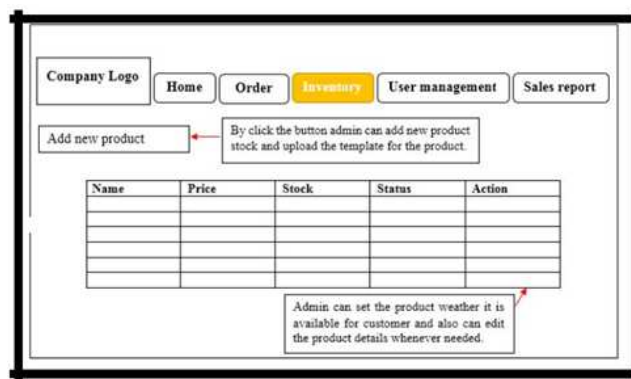**Figure 9.** Customer selected product details

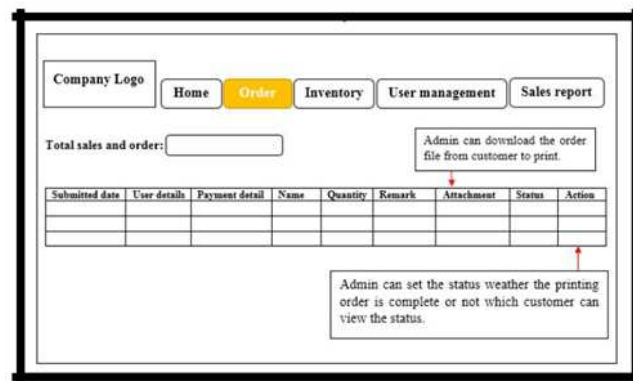**Figure 10.** Administrator product stock page

Figure 11. Customer's orders for admin

5.   Implementation and Testing

5.1   Implementation of System

Login operation ensures that all the system users can only access the validated module according to their category. The admin and customers have to log in the system by using their username and password. The customer can access the system without login but if they want to order the materials they have to log in the system. If they were a new customer for the system, they have to register their self into the system then only the customer can log in the system. Figure 12 shows the login page for the admin and customer whereas Figure 13 shows the registration module for admin and the customer.

Figure 12. Admin and customer login page

Figure 13. New membership registration page

All data entered by the user into the system will be stored in the database. Modules that are involved with databases are information storage modules such as user registration, product list, and product order. One of the examples is shown in the below Figure 14 is the program section to insert the user's data into the database.

Figure 14. Program section to insert user data into database

Product module page will display the printing services that provided at the shop. The printing services will display in categories so that it will be easier for the customer to view these materials. The printing material will display with their description and the price. Figure 15 shows the product module for customer page.
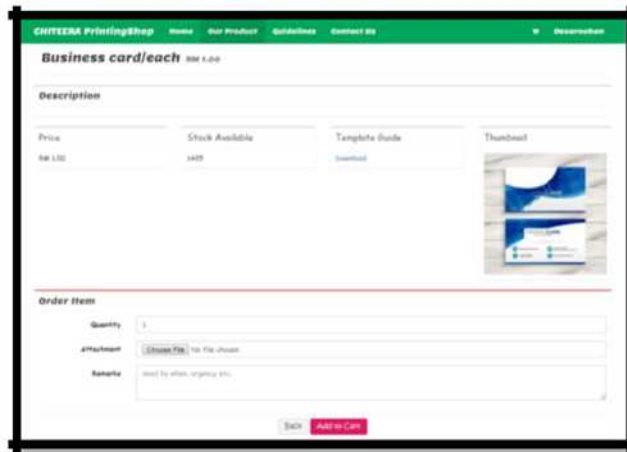
Figure 15. Product order page for customer

Add to cart is a module where a customer can view and make confirm about their printing orders before they proceed to checkout. If they want to cancel any of their orders they can click Remove Item to cancel their order. Figure 16 shows the module for add to cart module.
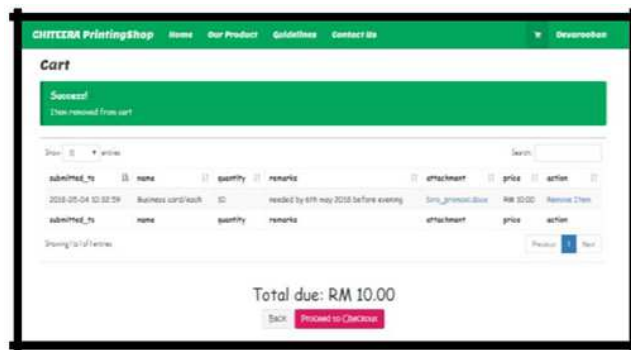

Figure 16. Add to cart page for customer

Admin can download the customer's printing material for the printing process at the customer's order module at admin side. The admin also can set the printing status whether the printing is pending, in process or complete. So once the admin set the status the customer can view their printing material status. If the status is complete the customer can collect their material at the shop.

Once the product quantity is less than or equals to 10 units it will show low stock so that the administrator can be alert of the product stock outages. Moreover, the admin can set active or inactive the printing product to the customer view when there is no stock for the printing product. Figure 17 shows the product stock module for the admin page.
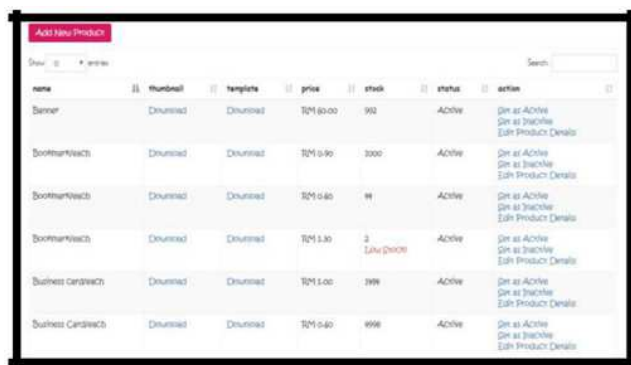

Figure 17. Product stock module for admin

Admin can view their total sales report in graph view by daily, weekly and monthly. Admin can also view their sales report in a list view at the below of the graph for more detailed information. Figure 18 shows the Report Module for the admin page.
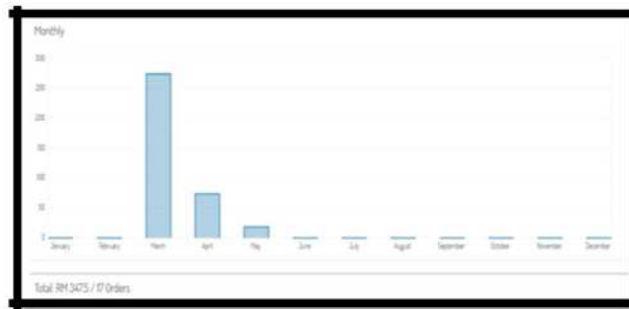

Figure 18. Sales report module for admin

5.2   User Acceptance Testing

The system testing was carried out at a specific time. The functionality testing is done by the system developer while the user acceptance testing is done by the admin and staff of Chiteera Printing shop. From the system testing result, every part of the system can run smoothly and correctly.

Apart from that, the outcome of the user acceptance testing is also quite satisfying. Every module of the system is functioning. For overall testing of the system, there are considered very satisfying with the system interface and the system design. With the proposed system, their daily work is eased and they no longer need to do their daily sales report manually and the customers of the shop also do not need to wait too long in a queue to print up their stuff.

6.   Conclusion

There are some benefits of the Smart Printing Management System. Among the benefits are that the administrator can take their online printing orders from the customers. Making the system operate online allows users to access the system anytime and anywhere. Moreover, the system also keeps their daily printing sales records of their customer's order in the system, so that the administrator does not have to take their orders manually. Their sales records also will be kept safely in the system without any redundancy. Their printing sales record will be calculated automatically. Administrators do not have to calculate manually and they can view their sales in graph view by daily, weekly and monthly. The system also will manage their printing stock as well which is if their printing stock is low, the system will display low stock to the administrator so that the admin can be alert of their product stock as well. Furthermore, the administrator can also add their product stock and also can edit the product details whenever they want. The printing product sold by this shop are sorted by category. Therefore, the customers can find and view the printing product information more easily by the category that they want to order. Furthermore, this system also will provide a printing template for each category. The Customer can download the template provided if and customize it with their own creativity before they upload for order.

The system allows only the insertion of those printing product stock and details one by one. As such, this can be time-consuming and tedious for the administrator and stuff. The printing product sales module does not support any special function such as a promotion or discount. Moreover, the system also didn't have provided any online payment. The customer has to pay by bank transfer with the provided account number or cash on delivery which makes payment at the shop itself.

This system should have to provide a module which is the customer can choose their printing templates in the system itself and edit the template in the system itself before uploading for order. This will make the customer much easier. The system also should provide a variety of template designs for each category of the printing. Moreover, the system also should a notification alert to the admin once the printing product low in stock because currently, the system will display a message "low stock" whenever the product stock is low.

As a conclusion, the proposed system has been successfully developed and achieved its objectives and within the scopes as stated in chapter 1. The system is able to allow the administrator and customers to log in into the system. With the login system, the information of the system is more secure compared to a paper-based method. The Administrator can download customer's printing orders. They also can create, read, update and delete the product stock. On the other hand, the customers can download and upload the template and make their orders. In this project, the waterfall model has been chosen to develop the system. Together with this project, there is Flowchart, Data Flow Diagram (DFD) and Entity Relationship Diagram (ERD) to help the understanding of the system in a more detailed manner in terms of the functionality. The user interfaces and database are designed to make user-friendly and suit the need of the system. The actual system is tested by some of the customers of the Chiteera Printinshop and some of the staff to get their feedback and comments about the developed system. Although the proposed system had achieved its objectives, the future enhancement and improvement of the current system can be done to produce a system with more functionalities.

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