

Design and Development of Web-Based Printing Management Information System for Digital Printing MSMEs

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ARTICLE INFO	ABSTRACT
Keywords: Data Flow Diagrams, Digital Management Information System, Micro, Small, and Medium Enterprises, Printing, Web-based Application.	The rapid progress of digital technology in the modern era has changed the educational landscape significantly, requiring knowledge of digital printing as a fundamental competency in the learning process. This research aims to analyse the role of digital printing application innovation in supporting relevant and adaptive learning. Using a qualitative descriptive approach, data collection was carried out through observation, interviews and documentation. This approach was chosen because it aims to understand in depth the phenomenon of using digital printing applications and their role in supporting learning in the modern era. However, the use of digital printing applications still faces various challenges, such as limited facilities, lack of understanding of technology, and less than optimal integration in the learning process. This application successfully integrates all business processes, from ordering and uploading designs to payment, production, quality control and delivery, into one platform. This application can increase efficiency, reduce human error, and improve service quality for micro, small and medium digital printing businesses. This application can also be developed for further research.
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INTRODUCTION

The development of information and communication technology in the modern era has brought significant changes to various aspects of life, including education. Digital transformation demands increased digital printing as a key competency for students (school pupils or university students) and educators (teachers or lecturers). Digitalization has changed the way students (school pupils or university students) access information, learn, and complete academic assignments. Learning resources are no longer limited to printed textbooks, but are now widely available through various digital platforms such as e-books, online journals, and interactive learning media. Digital printing encompasses more than just the ability to use technological devices; it also encompasses the skills to understand, evaluate, and utilize information critically and creatively.

Along with the increasing need for relevant and adaptive learning, learning media has also undergone significant development. One innovation supporting this is digital printing applications. This technology enables fast, flexible, and high-quality printing, allowing it to be used to produce a variety of learning media, such as modules, educational posters, infographics, and engaging and interactive presentation materials. The adaptive learning design and development method presented provides personal access to various learning objects equipped with models and stored for each learner for repeated learning (Kem, 2022). The adaptive learning is a contemporary method that coordinates human and digital resources to meet the needs of each student (Abd Majid & Mafarjaa, 2024). Digital learning models in adaptive hypermedia systems can achieve adaptive learning, and future job prospects (Apoki et al., 2020). The development of digital printing applications can facilitate users in the learning process (Huda et al., 2022).

On the other hand, academic needs (both in schools and universities) are increasingly diverse, ranging from the provision of teaching materials and scientific publications to engaging and interactive learning media. The computer applications or software can facilitate students, lecturers, and academic administrators in accessing and managing data quickly and accurately (Setiawan et al., 2025). The students who use interactive, environment-based learning media have higher science learning outcomes than students who use non-interactive learning media. There are many ways to make classroom learning engaging and dynamic, including using educational technology (Kinanti & Hernawan, 2023). In this study, digital or online printing is presented as an innovation that can support the learning process by providing fast, flexible, and high-quality print results. The digital media was more effective than the printed media used in teaching (Ratminingsih & Budasi, 2020). Computer applications or software can help simplify the process of recording transactions and managing business data for Micro, Small, and Medium Enterprises (MSMEs) using digital printing (Yuda et al., 2024).

The use of digital printing applications in education has the potential to strengthen digital printing, particularly in the production and distribution of information. The integration of print, audio-visual, and computer technologies creates a pedagogical synergy that can strengthen motivation, enhance cognitive effectiveness, and support collaborative and independent learning (Trinova et al., 2025). Students will become not only consumers of information but also producers of creative and innovative content. The findings of review

issues as the most important factor interpreting students' behaviour in printing interactive digital learning objects (Rostaminezhad, 2018). This aligns with the demands of 21st-century learning, which emphasizes critical thinking, creativity, collaboration, and communication skills. The use of digital printing has a positive and significant impact on the economic value of products from Micro, Small, and Medium Enterprises (MSMEs) (Suprana, 2025).

However, in practice, the use of digital printing applications to support digital printing still faces various challenges, such as limited facilities, a lack of technological understanding, and suboptimal integration into the learning process. Therefore, a more in-depth study is needed on how innovative digital printing applications can be optimally utilized to strengthen digital printing and support learning that is relevant to current developments.

Furthermore, the use of technology in academic activities is often limited to basic uses, such as typing assignments or accessing social media, without a deeper understanding of its use as a productive and innovative learning tool. Individual digital printing facilitates the use of e-learning, and should be considered when examining the impact of e-learning on performance (Mohammadyari & Singh, 2015). This indicates that digital printing has not been optimally utilized to support a learning process that is relevant to the demands of the times. The Nigerian government, supported by the private sector, should assist public libraries with ICT facilities that enable them to acquire ICT literacy skills and enhance digital printing for development (Dora & Georgina, n.d.). The use of information and communication technology can enable the learning process to take place without the constraints of space and time, meaning that learning does not only occur in the classroom and during class hours (Lestari & Amalia, 2023).

On the other hand, the future world of work demands individuals who possess not only academic knowledge but also critical thinking and creativity, as well as strong digital skills. Therefore, improving digital printing is crucial to equip students to adapt to current developments and meet academic needs effectively and sustainably. The effectiveness of students' digital printing skills can create positive social change because students will be better prepared to live and interact safely and efficiently in a digital-based society. Digital printing production techniques can demonstrate improvements in participants' design skills (Erwin & Mohammed, 2022).

RESEARCH METHOD

Research Approaches and Types

This research uses a descriptive qualitative approach. Qualitative research is generally conducted across a wide and evolving range of interpretive paradigms, approaches, methods, evaluation practices, and research products (Smith & Sparkes, 2020). Qualitative descriptive research is a research method that describes descriptively and uses qualitative data based on research findings (Furidha, 2024). This approach was chosen because it aims to deeply understand the phenomenon of digital printing application utilization in strengthening digital printing and its role in supporting learning in the modern era. Qualitative research allows researchers to explore the actual experiences, perceptions, and practices of research subjects in a contextual manner.

The application designed is a web-based digital printing software application that aims

to manage the entire business process, from ordering to delivery, in an integrated manner. This web-based digital printing software application allows customers to place orders online by uploading designs, selecting print specifications, making payments, and monitoring order status in real time.

Research Location and Subjects

This research was conducted at Universitas Trilogi, which has utilized digital technology in the learning process. Subjects were selected using purposive sampling, based on their experience and direct involvement with the use of digital printing applications.

Data Collection Techniques

Data in this study were collected using several techniques

1. Observation: Conducted to directly observe the process of using digital printing applications in learning activities, including interactions, media used, and student engagement.
2. Interviews: In-depth interviews were conducted with educators and students to gather information regarding their understanding of digital printing, their experiences using it in learning, and the benefits and challenges faced.
3. Documentation: Data collection included supporting documents such as digital printing modules or teaching materials, photographs of learning activities, and archives or reports related to technology use.

Data Analysis Techniques

Data analysis was conducted interactively and continuously through the following stages: Data Reduction: Simplifying and selecting data relevant to the research focus. Data Presentation: Organizing data into descriptive narratives for easy understanding. Conclusion Drawing: Interpreting data to find meaning and answer the problem formulation.

Business Process Analysis

The business process can be seen in Figure 1 below.

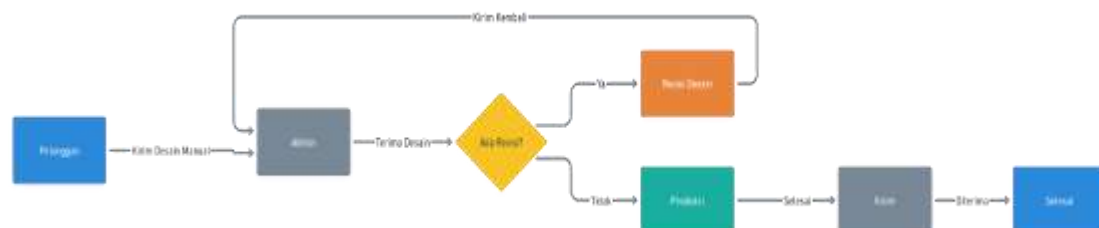


Figure 1. Analysis of the previous business process

Obstacles encountered in the previous business process were:

- Undocumented
- Error-prone

RESULT AND DISCUSSION

The business process analysis

Interface The business process analysis of digital printing micro, small, and medium enterprises (MSMEs) proposed in this study can be seen in Figure 2 below.

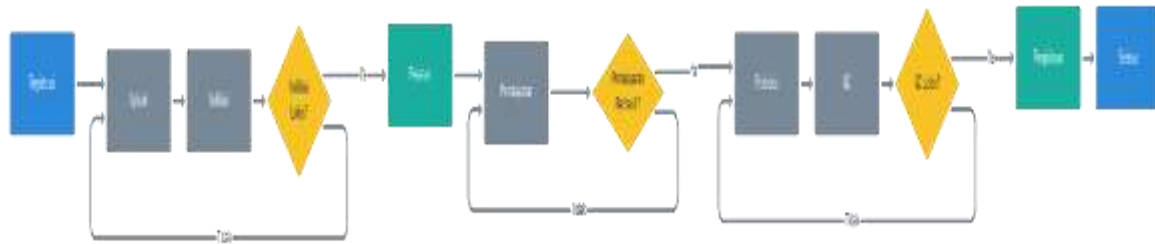


Figure 2. Proposed business process analysis

Figure 2 above shows the advantages of using a digital printing application:

Efficient human resources

Complete documentation

Easy monitoring

Data Flow Diagram (DFD) Design

Data Flow Diagram (DFD) design is used to model data flow within a system in a clear, structured, and easy-to-understand manner, thus aiding in more effective system analysis, design, and development. According to (Jogiyanto, 2008), a Data Flow Diagram (DFD) is an effective tool for understanding business processes in information systems. A Data Flow Diagram (DFD) is a diagram that depicts the flow of data from one entity to another, or from one system to another. The Data Flow Diagram (DFD) designed and used for the needs of Micro, Small, and Medium Enterprises (MSMEs) in the digital printing sector is as follows:

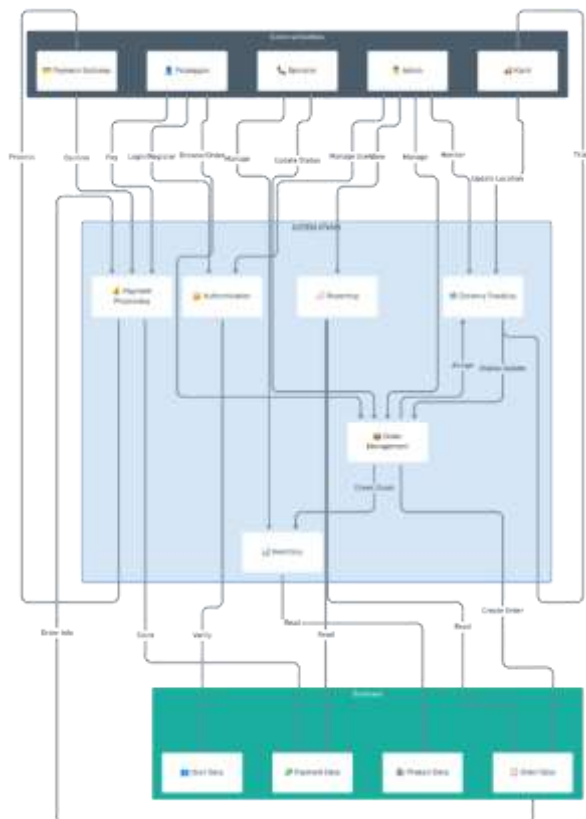


Figure 3. Data Flow Diagram (DFD) for a Digital Printing MSME

a) Entities Involved

Customers place orders and make payments
 Admins manage and monitor the system
 Operators assist with operational processes
 Couriers deliver orders
 Payment Gateways process payments

b) Main System Processes

User login authentication and verification
 Order Management manages orders
 Inventory checks material/product stock
 Payment Processing processes payments
 Shipment Tracking monitors deliveries
 Reporting generates reports

c) Data Storage (Database)

User Data
 Product Data
 Order Data
 Payment Data

d) System Flow (Simple)

Customers log in and place orders, and the system checks stock
 Payment is made, and the system verifies it
 The order is processed, and the courier then delivers it
 Order status can be monitored and reported.

This DFD shows that all processes in the system are integrated to effectively support the operations of a digital printing MSME.

Level 0 Data Flow Diagram (DFD) Design

Level 0 DFDs depict the main processes occurring within a digital printing information system in greater detail than context diagrams. At this level, the system is divided into several main processes that interact with external entities and data stores.

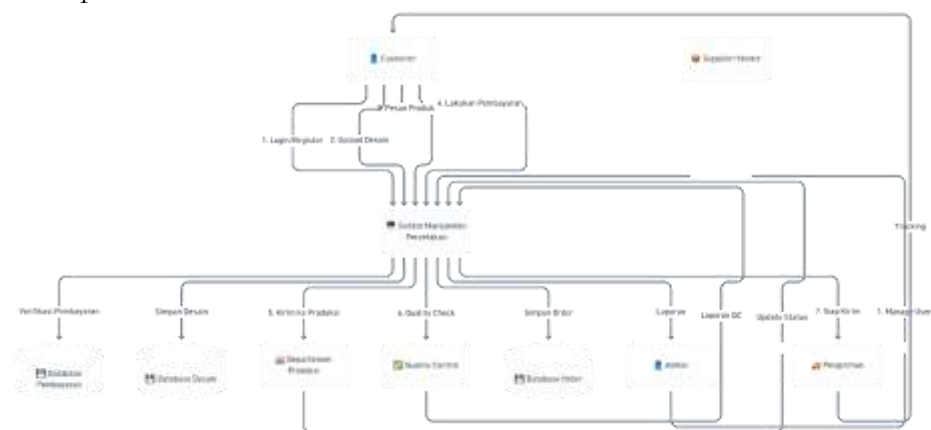


Figure 4. Data Flow Diagram (DFD) Design Level 0 for a Digital Printing MSME

The system being designed is a Printing Management System, which serves as a central processing point for all business activities. This system receives input from customers, processes the data, and produces output in the form of order status information, reports,

and shipping information.

This Level 0 Data Flow Diagram (DFD) contains several main processes:

- a) **Order Management:** This process is the initial stage where customers log in, select a printing service, and upload a design. The data entered by the customer is then stored in the Order Database and Design Database, which serve as the system's primary data.
- b) **Payment Validation and Verification Process:** After placing an order, the customer makes a payment. The system then processes the payment data and stores it in the Payment Database. This process ensures that the transaction is valid before the order is processed further.
- c) **Design Management Process:** Design files uploaded by customers are stored and reviewed by the system and the admin. This process ensures that the designs meet printing standards, such as file format, size, and resolution.
- d) **Production Process:** After the order and payment are validated, the system forwards the order data to the production department. The production department then executes the printing process based on predetermined specifications.
- e) **Quality Control (QC) Process:** After the production process is complete, the printed products will be inspected by the Quality Control department. The purpose of this process is to ensure that the printed products meet quality standards. If the product does not meet these standards, it will be returned to the production process.
- f) **Shipping Process:** Products that have passed quality control will be forwarded to the shipping department. Shipping data will be processed and stored, and the shipping status will be updated in the system for customer monitoring.
- g) **User and Admin Management Process:** This process includes login activities, user data management, and system monitoring by the admin. Admins can also view reports on orders, payments, and production activity.

Interface Design

Interface design is a crucial part of any development system, because it serves as a medium of interaction between the user and the system. A good interface must adhere to the principles of user-friendliness, be easy to understand, and provide an optimal user experience. According to (Suyanto, 2005), a good interface must be simple, consistent, and responsive so that users can use the system effectively. The interface design used in this study can be seen in the explanation below. In the digital printing information system being designed, there are several main pages used by users: customers and admins.

Login Page

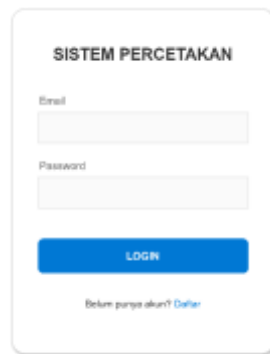
The login page is used for user authentication before accessing the system. Functions:

- Verify username and password
- Direct users according to their role (admin or customer)

Components:

- Email/Username Input
- Password Input
- Login Button

- Registration Link



The image shows a login form titled "SISTEM PERCETAKAN". It contains two input fields: "Email" and "Password". Below these fields is a blue "LOGIN" button. At the bottom, there is a link that says "Belum punya akun? Daftar".

Figure 5. Login Page View

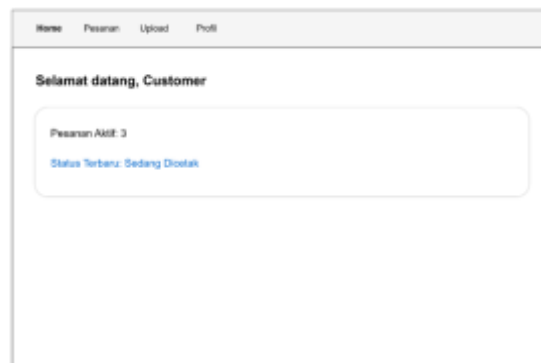
Customer Dashboard

This page is the main page for customers after logging in. Functions:

- Displays the main menu
- Quick access to orders and order status

Components:

- Menus: Home, Orders, Upload Design, Profile
- Order Summary
- Latest status



The image shows a customer dashboard. At the top, there is a navigation bar with links: "Home", "Pesanan", "Upload", and "Profil". Below the navigation bar, the main content area says "Selamat datang, Customer". Underneath, there is a box containing "Pesanan Aktif: 3" and a link "Status Terbaru: Sedang Diproces".

Figure 6. Customer Dashboard View

Create, Read, Update, dan Delete (CRUD)

This page is used to upload design files before placing an order. Function:

- Upload design files
- Validate files (format, size)

Components:

- Select print service type
- Upload files
- File format information
- Next button

Figure 7. Create, Read, Update, dan Delete (CRUD) View

Ordering

This page is used to place an order for a design that has been uploaded to the printing service. Function:

- Specify print specifications
- Automatic price calculation

Components:

- Product selection
- Quantity
- Specifications (material, size)
- Total price

Figure 8. Digital Printing Ordering View

Payment

This page is used to complete the payment transaction after placing an order/checkout.

Function:

- Display payment details
- Select payment method

Components:

- Total payment
- Payment method
- Confirm button

Figure 9. Digital Printing Payment View

Order Monitoring

This page is used to monitor the order process. Function:

- Displays real-time status

Status:

- Awaiting payment
- Processed
- Printed
- QC
- Shipped



Figure 10. Digital Printing Order Monitoring

Admin Dashboard

The admin dashboard is used to manage all system activities. Function:

- Monitor orders
- Manage production
- View reports

Components:

- Menu: Orders, Production, QC, Shipping, Reports
- Sales statistics



Figure 11. Digital Printing Admin Dashboard

Report Dashboard

This page is used to display business reports. Function:

- Displays sales data
- Assists in decision-making

Components:

- Sales graph
- Total revenue
- Date filter



Figure 12. Digital Printing Report Dashboard

CONCLUSION

Based on the design results of the web-based digital printing information system, it can be concluded that this system can provide solutions to various problems faced by digital printing MSMEs that still use manual methods. With this system, all business processes, from ordering and uploading designs to payment, production, quality control, and shipping, can be integrated into a single platform. System modelling using Data Flow Diagrams (DFDs) helps understand the overall data flow. This system also supports real-time monitoring through a dashboard, making it easier for managers to oversee operational activities. Thus, this system is expected to increase efficiency, reduce human error, and improve service quality for digital printing MSMEs.

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