Electronic Storefront Development Using Responsive Web Design (ACECS)

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Article Info

ABSTRACT

Food and beverage (F&B) businesses often encounter a common issue: employees struggling to manage customer orders efficiently. Moreover, the lack of a computerized system and online presence can result in the physical location becoming overcrowded during peak hours, causing potential customers to be discouraged by lengthy waiting times. To address the issue, the ordering process needs to be computerized for improved efficiency. This study aims to achieve several objectives: identifying user and system requirements for an e-commerce system in F&B businesses, creating and developing a web-based e-commerce system using responsive web design, and evaluating the system's functionality and usability. To initiate this research, a preliminary analysis of system requirements was conducted through surveys and literature review. The design phase followed, producing essential design diagrams such as the data flow diagram (DFD), which plays a crucial role in shaping system functionalities. The implementation's backend employs the MySQL database for effective data storage and PHP for data processing. On the frontend, Figma was used for initial system design, while Bootstrap, cascading style sheets (CSS), and hypertext markup language (HTML) were used to create a functional website. The research culminated in functionality and usability testing. Usability testing involved expert evaluation with input from two experts. The results acquired give a positive indicator for further implementation. This study sheds light on a tool that could enhance the order process in F&B business outlets. Responsive design features were incorporated to ensure a consistent and user-friendly experience across various devices.

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1. Introduction

Since the advent of the Internet, the size of digital economies has been steadily growing year by year. Moreover, progress in the financial technology sector has further accelerated the process of digitalization among enterprises, encompassing even small and medium-sized businesses. Within the present capitalist society, businesses must embrace the latest market trends to ensure their sustainable operation. The advancements in technology and the Internet have elevated the significance of digital economies, necessitating a shift away from regarding them as optional or experimental.

A considerable amount of e-commerce platforms is in operation nowadays, propelling the digital economy forward. There are even platforms focusing on food and beverages, allowing customers to make an order online and have the food delivered straight to their home, or alternatively, allowing them to just walk in and pick up later. Furthermore, many F&B businesses have also started to use these services to allow their company to essentially compete with other similar businesses. The market segment for online customers is wide and can be reached via online applications; web-based or mobile. The potential to generate greater profits can be attained as shown in the increase of income and expenditure in the food and beverage industry from 2015 to 2019 [1].

A study was conducted in an F&B company selling coffee, other beverages and selected pastries. Ahvelo Coffee Shop (Ahvello) is a relatively small coffee establishment located in Laman Rafa, near Kuala Terengganu. Currently, Ahvelo business process starts when the customer arrives on the premise and make an order over the counter. Typically, customers place their orders after reviewing the assortment of available items presented on a physical menu positioned atop the order counter. These menu items are also promoted on social media, and some customers might already know what they want to order after viewing the social media of Ahvelo Coffee. The employees stationed at the counter will manually and physically receive the order, utilizing the cash register. Since there is no specific system being used for ordering, the output of the cash register would be used in the kitchen to guide the barista and chef.

A significant challenge faced by the shop revolves around effectively managing customer orders, primarily due to the absence of dedicated systems utilized by the employees. The current manual approach to tracking and handling orders leaves room for potential errors, particularly when the waiter incorrectly inputs the order into the cash register, which can lead to mistakes in the barista's preparation process. Furthermore, the limited staff availability occasionally requires the cashier to also take on waiter responsibilities, further burdening a single employee with an increased workload. Consequently, it becomes imperative for Ahvelo Coffee to implement a tailored system aimed at enhancing both the customer experience and employee efficiency.

To address the challenges encountered by the company, we propose the implementation of an electronic storefront, designed to enhance the systematic management of orders. This study aims to achieve several objectives: identifying user and system requirements for an e-commerce system in F&B businesses, creating and developing a web-based e-commerce system using responsive web design, and evaluating the system's functionality and usability.

2. Literature Review

2.1 E-Commerce

According to Jamsheer [2], electronic commerce (e-commerce) involves the use of telecommunication networks to automate business interactions and workflows. Additionally, Taher [3] contends that e-commerce includes exchanging organizational data, maintaining business relationships, and conducting operational transactions through telecommunication systems. Kalakota and Whinston [4] characterize e-commerce as leveraging computer technology, the internet, and collaborative software to facilitate the exchange of product descriptions and visuals, trade offers and procurement details, and other essential information intended for sharing with consumers, suppliers, employees, or the broader community. Table 1 summarizes among the benefits of e-commerce as cited from several sources.

Table 1. Benefits of E-Commerce

Benefits	Customers	Merchants
Convenience	Shop from anywhere and anytime [2] [5]	Reach global customer base [4] [6]
	Access a wide variety of products] [3]	Reduce operational costs [6] [4]
Choice and Information	Compare prices, features, and reviews [3]	Offer a wider range of products [5]
	Easily find product information [3]	Reach niche markets effectively [3]
Global Reach	Access products from around the world [2]	Expand market reach [4] [6]
	Explore international brands [3]	
Cost Efficiency	Access to deals and discounts [2]	Reduce overhead costs [4]
	Save on travel expenses [3]	
Time Savings	Shorter shopping time [3]	Streamline inventory management [3]
24/7 Availability	Online stores operate round the clock [6]	

2.2 Electronic Storefront

A single company's Web site where products or services are sold and usually has an online shopping cart associated with it. Many webstores target a specific industry and find their own unique corner of the market [5]. Electronic storefronts encompass different forms of e-commerce beyond online malls and electronic portals. It may belong to a manufacturer, a retailer or individuals selling from home. Mechanisms used for conducting sales in electronic storefront comprise of electronic catalog, search engine, electronic cart, shipment court, payment gateway, customer service and e-auction facilities [7].

2.3 Responsive Web Design

The main purpose of responsive web design is to have cross-platform, multi-functional, adaptive web pages. A responsive web page should be able to adapt to the screen resolution and change its layout and resize images accordingly [8]. One of the main goals of responsive web design is to allow smaller screens, such as a smartphone, to access web pages easily, as well as serve media contents more efficiently [9]. This means that responsive web design is significantly important for smartphone users. The ownership of smartphones among individuals in Malaysia is very high, which is around 96%, compared to usage of computers such as desktops, laptops, or tablets, which only stands at 80% [1]. As such, the implementation of responsive web design is important to ensure that the user experience is optimal on devices with a small physical screen such as a smartphone.

The implementation of responsive web design could benefit not just the user, but also the owner of said system. This is because maintaining one single website with responsive web design is much better than maintaining two separate websites for two different screen sizes, not just for managing purposes, but also for search engine optimization (SEO) purposes [10].

To implement responsive web design, the latest versions of web technologies that are typically used to build a website must be used. This is because older versions of said web technologies do not have the necessary features that would enable responsive web design to happen. The technologies include HTML5 and CSS3. Aside from technologies used to make responsive web design possible, there are also other factors that play an important role in designing a responsive website. Such factors include the implementation of features from the used technology. Such features include a fluid grid, flexible images, as well as media queries [8].

3. Methodology

Within this section, the employed project methodology for the creation of the system is examined-namely, an adapted Waterfall Model. The phases within this methodology have been tailored from the initial model detailed in [11]. Each phase encompasses distinct tasks to be executed throughout the development journey. The entirety of the system development approach is encapsulated in Table 2 for reference.

Table 2. ACECS Project Development Methodology

Phases	Activities	Outcome
SYSTEM PLANNING	• Conduct interview with the business owner • Identify flow of the current business process • Identify problems related to current business process.	• The flow of current business process is analysed • Description of the problem
SYSTEM DEVELOPMENT	**ANALYSIS** • Gather user and system requirements by interviewing the business owner • Determine the appropriate related theory and system development methodology	• User requirements • System requirements • Responsive web design theory • Adapted Waterfall Model
	DESIGN • Design Context Diagram • Design Data Flow Diagram • Design Entity Relationship Diagram • Design Site Map • Design User Interface • Design Test Plan • Design Usability Questions for Expert	• Context Diagram • Data Flow Diagram • Entity Relationship Diagram • User Interface Design • Test Plan • Expert Questionnaire
	IMPLEMENTATION • Develop the Ahvelo Coffee electronic storefront	• Completed Ahvelo Coffee electronic storefront
	TESTING AND EVALUATION • Conduct testing session for functionality and usability • Analyse result from the test	• Functionality and usability evaluation result
SYSTEM DOCUMENTATION	• Compiling and refining a complete report	• A complete project report

3.1 System Planning

During the system planning phase, the goals are to gather relevant information and pinpoint issues in managing the current business process at the chosen company. Interviews are employed as a method for gathering information and understanding problems. The business owner was contacted via WhatsApp and the interview was conducted via Google Forms, after discussing with the business owner on how to approach the interview.

3.2 System Development

The first step in the system development phase is analysis. The functional and non-functional requirements and user requirements are gathered via an interview session. The analysis activities involve comparing the similar characteristics of the existing system, identifying a suitable system development model, and researching suitable theory for the proposed system. Next is the design process. In this process, Context Diagram, Data Flow Diagram, Entity Relationship Diagram, Site Map, and User Interface Design have been constructed. This process aims to provide a clear perspective on how the proposed system will operate at the end of the project.

Figures 1 and 2 demonstrate a mock-up of the user interface design for the system. The user interface design includes a header, which includes a navigation bar, search field, shopping cart, and user account button. In addition, there is also a picture carousel which functions as a quick way to communicate to the users about the latest information such as news, promotions, and deals. This element is purposefully made big so that it can catch the eye of the user. Next, the bestseller listing is put on top of the item listing, since recurring users might want to reorder the same item again, or for new users, they might want to buy the most recommended item. Lastly, we have categories which help organize the product items into neat categories.
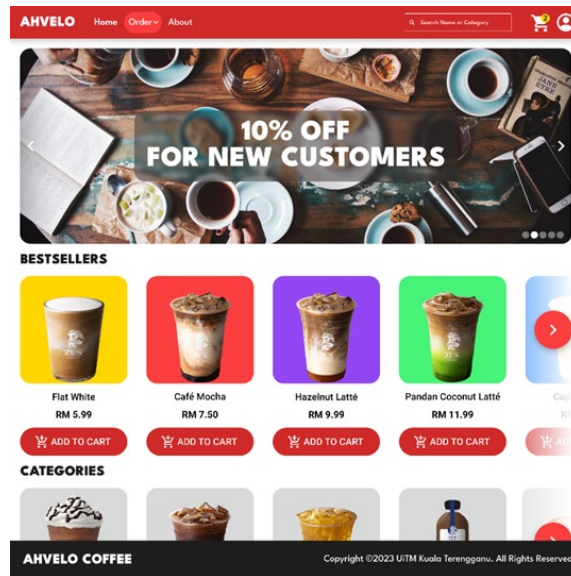
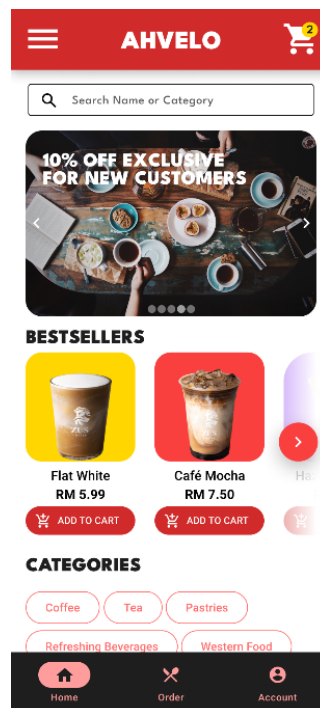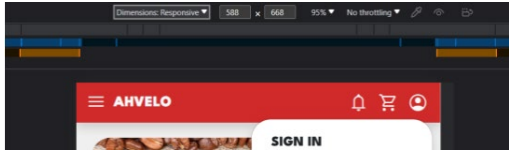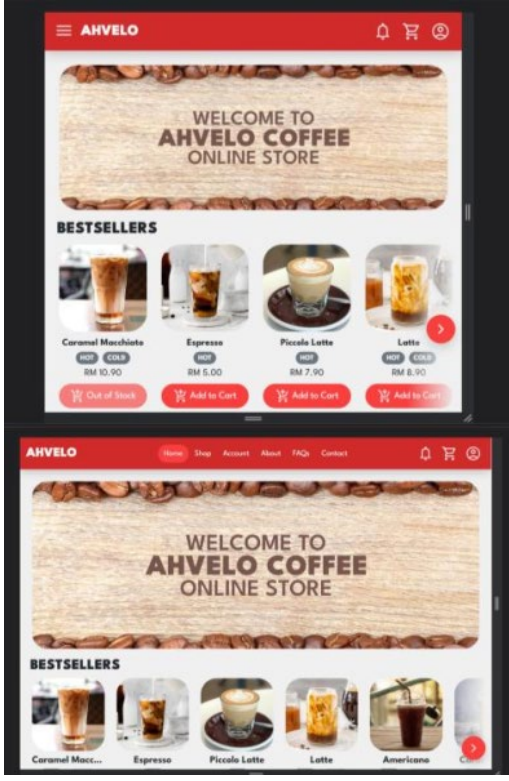Figure 1. Mock User Interface Design for the Proposed System

Figure 2. Mobile Version of the Mock User Interface Design

The development process takes place when all the designs are completed. In this process, the code is produced, and the focus for the developer is to produce a well-functioning system based on the collected requirements and the chosen theory. Table 3 depicts three sample features of the theory that had been implemented on ACECS.

The final phase is testing and evaluation activity which involves testing the functionality and usability of the system. The functionality testing was done by the developer and usability testing was conducted by the expert users. The results are presented in section 4 of this paper.

Table 3. Responsive Web Design Features Implemented in ACECS

Element	Example	Description
Media queries		Media queries provides the capability to resize HTML elements dynamically according to current viewport size using cascading styles sheet (CSS)
Flexible images		This feature enables the images to resize according to the current width of the viewport.
Fluid grid		Fluid grids would enable responsive web by arranging and resizing elements in the grid according to current viewport size.

3.3 System Documentation

The final stage is when all the information within the system is brought together into a single report once the project is finished. System documentation outlines how the project progressed and acts as a guide for users regarding the ACECS project. As a result, the documentation must be created with a clear intention and designed to be easily comprehensible for future users.

4. Results and Discussion

The system's functionality and usability underwent evaluation to ensure its effectiveness. The assessment included both developer and tester involvement, with a focus on functionality testing. A test plan served as the tool for gathering the resulting observations. The test plan contains a list of functionalities available for the customers, staff, and admin in the system. Following the testing phase's conclusion, the developer has determined that the system functions effectively and is prepared for evaluation by expert users.

The system was evaluated by two experts from a respectable background. Evaluation is essential in ensuring that the usability of the system acceptable and is ready for production. Furthermore, feedback from this evaluation could also help improve the system usability, thus improving the overall customer experience when using the system. To conduct the evaluation, a questionnaire was prepared for the experts to evaluate the system on. The questionnaire was divided into six constructs, namely perceived usefulness, perceived ease of use, perceived convenience, system quality, and satisfaction. The theory used in this project, which is responsive web design [12-14], was also added as the last section of the questionnaire. Likert scale was used as the grading method for the questionnaire. This means that the expert will tick a box scoring 1 to 5, with 1 being "strongly disagree" and 5 being "strongly agree".

For the first section, the perceived usefulness of the system was inquired. In this case, the experts were asked whether they perceived the system as useful. Simple descriptions were used in the questionnaire to ensure that the expert could fully understand how to respond. In this case, both experts generally agree that the system is useful. However, the first expert commented on the phrasing for the user settings user interface. Figure 3 shows comments and suggestions from the experts for perceived usefulness construct.

SECTION A: PERCEIVED USEFULNESS		
Item	Description	Likert scale (1-5)
A1	The system could help me order items more quickly.	Expert 1: 4 Expert 2: 4
A2	The system would improve my ordering experience.	Expert 1: 4 Expert 2: 4
A3	I find the system useful for the ordering process.	Expert 1: 4 Expert 2: 4
Comment		Suggestion
Expert 1: Preference tab in the customer page does not reflect the function. Expert 2: Ok.		Expert 1: Add customer personal preference for drinks etc. Expert 2: None.

Figure 3. Perceived Usefulness Evaluation

The next section is about the perceived ease of use. The experts involved in the evaluation were asked if the system is easy to use, or if it is easy to learn. This aspect of the evaluation could help determine if additional efforts are needed to ensure users could use the system as easily as possible. In this case, both experts generally perceived the system as easy to use. Expert 1 suggested that a system usage demo should be added. Figure 4 outlines findings for perceived ease of use construct.

SECTION B: PERCEIVED EASE OF USE		
Item	Description	Likert scale (1-5)
B1	Learning to use the system is easy for me.	Expert 1: 5 Expert 2: 5
B2	I find the system to be flexible to interact with.	Expert 1: 4 Expert 2: 4
B3	I find the system easy to use.	Expert 1: 5 Expert 2: 5
Comment		Suggestion
Expert 1: Good as there's FAQ. Expert 2: None		Expert 1: Add system usage demo Expert 2: None

Figure 4. Perceived Ease of Use Evaluation

Next, the experts were asked about the perceived convenience of the system. This section questions how the system can make it more convenient for users to complete the relevant tasks related to the system. Figure 5 illustrates evaluation results for perceived convenience construct.

SECTION C: PERCEIVED CONVENIENCE		
Item	Description	Likert scale (1-5)
C1	I think the system could help me save time when ordering.	Expert 1: 4 Expert 2: 3
C2	I think the system helps me to order items more conveniently.	Expert 1: 4 Expert 2: 4
C3	I feel like the system makes it more convenient for me to order items.	Expert 1: 4 Expert 2: 5
Comment		Suggestion
Expert 1: None Expert 2: Checkout process contains redundant page		Expert 1: System demo should be added. Expert 2: Checkout process could be shortened

Figure 5. Perceived Convenience Evaluation

Then, the experts were questioned about their opinions on the system quality. This inquiry holds immense importance when evaluating whether the fundamental system design is effectively structured or not. Both experts generally agree that the system is of good quality, albeit with some minor bugs that should be reviewed. Expert comments and suggestions for system quality construct are displayed in Figure 6.

SECTION D: SYSTEM QUALITY		
Item	Description	Likert scale (1-5)
D1	I feel like the system responds to my needs.	Expert 1: 5 Expert 2: 5
D2	I think the system allows me to operate specific features such as navigation more conveniently.	Expert 1: 4 Expert 2: 4
D3	I think the system architecture for this system is logical.	Expert 1: 5 Expert 2: 5
Comment		Suggestion
Expert 1: System issues when adding to cart. Expert 2: Cart listing has bugs, and some other minor bugs		Expert 1: Try to resolve the problems. Expert 2: Try to fix the bugs

Figure 6. System Quality Evaluation

Subsequently, the survey transitions to inquiring about the level of satisfaction experienced by experts using the system. This segment aimed to assess whether the system has already attained a level of satisfaction or if there exist any minor enhancements that could enhance its functionality. In this context, experts were invited to express their contentment with the system. The feedback from both experts consistently indicated contentment, as evidenced by their Likert scale scores of 4 or 5. Satisfaction evaluation results are shown in Figure 7.

SECTION E: SATISFACTION		
Item	Description	Likert scale (1-5)
E1	I am quite satisfied with the system.	Expert 1: 5 Expert 2: 4
E2	The system functions meet my expectations.	Expert 1: 5 Expert 2: 5
E3	I have positive experience using the system.	Expert 1: 5 Expert 2: 5
Comment		Suggestion
Expert 1: The colour scheme is pleasant Expert 2: Good		Expert 1: None Expert 2: None

Figure 7. Satisfaction Evaluation

Lastly, the survey concludes with a segment focused on the utilization of the responsive web design theory, which, in this instance, constitutes the theoretical framework. The purpose of this section was to ascertain the extent to which the system had effectively incorporated the principles of responsive web design. In this context, the initial expert largely concurred that the system had successfully integrated responsive web design practices. However, the second expert's perspective leaned more towards a neutral stance. Notably, both experts provided valuable comments and suggestions that hold potential for enhancing the system's adherence to responsive web design principles. These insights could prove instrumental in optimizing the system's implementation of responsive web design. Figure 8 summarizes evaluation result for responsive web design elements utilized in ACECS.

SECTION F: RESPONSIVE WEB DESIGN		
Item	Description	Likert scale (1-5)
F1	I find that the system could adapt to changes on the screen resolution.	Expert 1: 5 Expert 2: 4
F2	I find that the system works well on smaller screens, such as a smartphone.	Expert 1: 4 Expert 2: 3
F3	I think that all the features of the responsive web design theory are implemented in this project.	Expert 1: 4 Expert 2: 3
Comment		Suggestion
Expert 1: Table layout needs to be improved for smaller screens. Expert 2: Some parts of the system are too large for larger screens, such as the product listing.		Expert 1: None Expert 2: Improve the overall sizing of the elements, as well as fix the table layout.

Figure 8. Responsive Web Design Evaluation

5. Conclusion

ACECS was developed with the purpose of facilitating order taking in an F&B business to enhance the process. The customers are allowed to make pre-orders before collecting their beverages later to reduce waiting times thus increasing satisfaction. The process of system development involved the incorporation of front-end and back-end components drawn from a range of reviews conducted on analogous existing websites. Within the system, elements of responsive web design, including media queries, flexible images, and fluid grids, have been seamlessly integrated. These components play a pivotal role in elevating the user experience when interacting with the application. The outcomes of the evaluation have yielded positive indicators, serving as valuable insights for potential enhancements to be made to the system in the future. Providing product recommendation based on previous purchases and add-on features that allow customer to customize item they want to purchase is seen as a promising future work for ACECS. In general, all the stated objectives of the study have been successfully accomplished. This study is expected to provide insights into a tool that has the potential to improve the order processing within F&B business establishments.

Conflict of Interest

The authors declare no conflict of interest in the subject matter or materials discussed in this manuscript.

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