Indonesian Journal of Electrical Engineering and Computer Science
Vol. 39, No. 1, July 2025, pp. 531∼544
ISSN: 2502-4752, DOI: 10.11591/ijeecs.v39.i1.pp531-544

Web GIS-based postcode alternative system for resolving "last mile" problem in Jordan's home delivery

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Article Info

Article history:

Received Jan 2, 2024
Revised Mar 2, 2025
Accepted Mar 26, 2025

Keywords:

Global positioning system
Home delivery
Jordan
Online shopping
Web GIS

ABSTRACT

As more and more people shop online, the postal code system must be more dependable. Due to the absence of a comprehensive postcode system, online purchases and shipping in the developing country of Jordan are complicated. This research paper proposes an alternative delivery system for delivering online purchases to customers without postal codes. Smartphone and computer-based geographic information system (GIS) applications evaluated in Jordan. The scientists found that the users were eager to adopt the system based on its ease of use and adoption rate. A questionnaire survey was distributed to 167 retail stores, delivery logistics employees, university students, and academics. The data collected were then analyzed using SPSS techniques such as POST HOC and ANOVA. To find a home delivery solution, we tested the suggested system app on both desktop and Smartphone platforms. The findings show that it is easier to locate a residential neighborhood. Customer trust and satisfaction with online purchases should increase due to the additional benefits of the system installation. Improve the effectiveness of home delivery services in Jordan with the use of artificial intelligence (AI). Both customers and stores prefer this system for online shopping rather than using postcodes. According to these data, experts can enhance their items by implementing digital sales strategies.

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1. INTRODUCTION

The rise of information technology (IT) and the internet as a shopping platform has revolutionized business models and customer services. The most prevalent form of electronic transaction, business-to-customer (B2C), has sparked a significant need for delivery services [1]. The success of internet shopping is heavily dependent on efficient home delivery, where customers can conveniently place orders online and the store takes care of fulfillment. This involves a systematic approach to managing, arranging, and preparing online orders for shipping to the customer's address [2]. With the evolution of the Web and advanced location technologies like web geographic information system (GIS) and global positioning system (GPS), retailers have significantly enhanced their online channels [3]. These technologies facilitate functions such as finding the nearest store, showing the location of the store, providing driving directions, and enabling third-party logistics to track vehicles, make informed decisions, and optimize routes [4]. Web GIS is used across various industries to collect, sort, alter, analyze, and maintain geospatial data [5]. Using the Internet, logistics companies can display specific earth location data, helping them in decision-making, route scheduling, and operational optimization [6]. Despite advances, the lack of efficient postcode systems in many countries has been a critical oversight [7].

Most research studies highlight the delivery service provided by retailers and delivery companies having a reliable delivery system to deliver customers' orders. For example, Machado *et al.* [8] argues that many delivery companies lack real-time monitoring for their delivery process based on several parameters. Allen *et al.* [9] investigated the challenges of parcel delivery services in London that delivery companies face, such as the time taken to deliver customer orders, the delivery failure rate, the delivery time window, and the management of delivery returns. In addition, Wahab *et al.* [10] investigated the challenges and barriers of parcel delivery in Malaysia to improve the online shopping and home delivery service. Buzzega and Novellani [1] studied the routing problems of home deliveries to customers and suggested using lockers as an alternative to direct delivery to the customer's doorstep. Shiyu [4] analyzed the challenges of home delivery and built a GPS/GIS-based system to solve the delivery problem. Finally, Duckham [3] identified GIS as an information system that has spatial capabilities to help home delivery companies easily locate their customer's addresses on the map and perform several operations. Moreover, positioning technologies such as GPS and GIS are crucial for enhancing transportation and distribution within supply chains, particularly in internet shopping where transportation is key [11]. Although developed countries benefit from advanced technologies to locate consumers' homes and improve delivery services, countries like Jordan face challenges due to the lack of reliable systems to identify consumer addresses. To address this, a web-based GIS application was proposed to improve Jordan's online shopping services. This research aim is twofold: to address home delivery challenges in Jordan and to evaluate the proposed system's usability and effectiveness on both PC and smartphone platforms.

The literature review highlights the importance of home delivery in e-commerce. It describes how online shopping and home delivery are intertwined, with the latter involving the physical distribution of products to a customer's doorstep or workplace [10]. The convenience and efficiency of home delivery have spurred the popularity of online shopping, transforming both information and communication technology (ICT) infrastructure and delivery services [9]. Customers now expect seamless coordination and prompt delivery, necessitating reliable shipping systems [12]. Despite advances, the literature acknowledges various challenges and the need for ongoing research to further enhance delivery services, taking into account specific customer needs, available technology, and the delivery process [13].

Inefficient and unreliable home delivery methods in Jordan are the main challenges and opportunities for improvement in this study. In addition, the lack of a complete and reliable addressing system causes these issues. The rapid expansion of e-commerce has made this issue worse, necessitating the need for a reliable delivery system. This study focuses on issues with home delivery that web-based GIS technology can resolve, replacing the postcode system to ensure a precise, quick, and reliable home delivery service [14]. This emphasizes the impact of IT and the Internet on the shopping industry, the importance of home delivery, and the challenges of insufficient address systems in developing countries such as Jordan. Therefore, this study proposes a system to improve online shopping and solve the problem of home delivery using web-based GIS [4]. The study is structured as follows: a comprehensive review was conducted in the second section. The third section then describes the architecture of the anticipated system, and the fourth section presents the applied methodology-results of the analysis and discussion of the system assessment presented in the fifth section. Finally, the conclusion summarizes the findings and discusses limitations and future work.

2. LITERATURE REVIEW

2.1. Home delivery service

Home delivery is a vital component in the contemporary landscape of e-commerce. The appeal of online shopping lies in its convenience, where consumers place orders and retailers fulfill them [15]. The process, known as order fulfillment, encompasses the meticulous processing and dispatch of online purchases to a designated location specified by the customer, as discussed in references [15], [16]. The synergy between online shopping and home delivery is undeniable; while the former involves the selection and transaction for various items from numerous vendors [17], the latter focuses on the physical delivery of these items to home or office [18].

The success and appeal of online shopping are largely attributed to the efficiency and convenience of home delivery services [19]. This system has significantly reduced waiting times, increased accessibility, and often decreased costs for consumers [9]. As the prevalence of online shopping and home delivery escalates, so does the evolution of ICT infrastructure and the operational dynamics of delivery services. Consumers, in turn, have grown to expect seamless logistics and prompt delivery with their online purchases [20]. Consequently, retailers are responsible for the operation of a reliable transportation system. Customers should be able to input precise delivery details and assist delivery personnel in accurately locating destinations with the help of such a system. However, these distribution systems for online purchasing are not without their shortcomings, despite the progress they have made, as noted in previous studies of [12], [13]. These studies underscore that a multitude of factors, including customer needs, available technology, and the intricacies of the delivery process, significantly influence the quality of delivery services [2]. The absence of a reliable delivery mechanism can severely impede the provision of secure, reliable, and timely delivery services [21], [22]. Hence, understanding these dynamics and continuously refining the delivery processes are crucial for meeting the evolving demands and expectations of online consumers.

2.2. Home delivery service in Jordan

Jordan, as a developing country, faces challenges with its delivery infrastructure, mainly due to the lack of a postcode system. This lack significantly complicates the process of online shopping and delivery within the nation. The Jordan Post Company (JPC) serves as the main provider of postal services in the kingdom [14], offering a variety of services, including e-services, short message service (SMS), mail, and banking, to its citizens [23]. However, due to the lack of a reliable delivery service and an established postcode system, JPC cannot provide home delivery services. Consequently, residents often rely on major international delivery companies like DHL, ARAMEX, TNT, and UPS to receive overseas goods. This reliance on international couriers highlights the challenges and inefficiencies faced in domestic delivery and transportation, largely due to the underdeveloped addressing schema in Jordan.

2.3. Logistics technology

GPS and GIS are at the forefront of modern positioning technologies, revolutionizing the way consumer logistical services operate. E-commerce businesses are highly dependent on these technologies for the efficient delivery of online orders to customers. In the realm of delivery logistics, GPS terminals equipped with communication modules in delivery vehicles serve as the primary system for tracking and locating. Meanwhile, online GIS systems manage and streamline delivery operations using GPS data to organize delivery routes [4], [8]. GIS use coordinates to gather, store, modify, analyze, and present data about the surface of the earth [24]. These data typically include geographical details such as latitude, longitude, and elevation [3]. Various industries, including transportation, urban planning, engineering, education, and business, leverage GIS to address operational challenges and enhance decision-making processes [3], [25]. In logistics, GIS contributes to the enhanced analysis, manipulation, retrieval, processing, and decision-making related to spatial data [26], [27]. The proliferation of advanced communication networks and increased computational power have enabled GIS services to be accessible online. Such online GIS services allow Internet-connected handheld devices, such as smartphones, to interact with central servers in location-based applications [28]. Web GIS, in particular, utilizes web browsers to access data from remote servers, facilitating online map viewing, retrieval, and analysis [6], [29]. In the mobile realm, popular operating systems like Nokia Symbian, RIM BlackBerry, Windows Mobile, Android, and iPhone support a variety of applications, whether they are native to the operating system, specific to the device, or web-based [30]. These mobile technologies, when integrated with other logistics technologies, play a crucial role in modern logistics. They aid in coordinating the flow of goods through processes such as route scheduling and optimization, vehicle location monitoring, and cargo dispatch [27], [31]. This integration marks a significant leap in the efficiency and effectiveness of logistical operations, paving the way for a more connected and streamlined future in delivery services.

3. SYSTEM DESIGN

The designed system consists of two platforms: a desktop and a smartphone platform with a map as shown in Figure 1. These platforms were developed to ensure flexibility and accessibility for a wide range of users, regardless of their device preferences. Both platforms provide real-time location tracking and map interaction features, which are essential for accurate delivery address identification and route planning. This dual-platform approach aims to streamline the delivery process by allowing customers and retailers to interact with the system easily on their preferred devices.

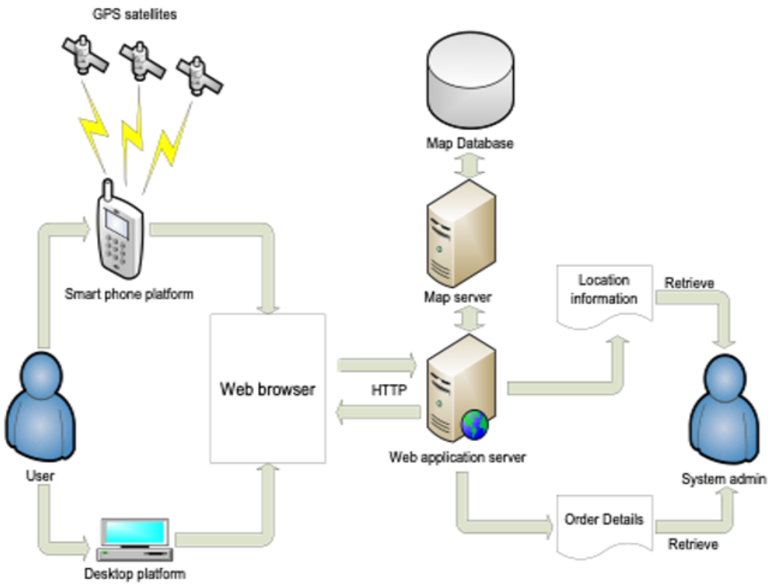

Figure 1. The designed system architecture

3.1. Desktop platform

The proposed desktop platform utilizes the browser/server (B/S) architecture, a robust client-server framework designed to process and analyze enquiries efficiently. This architecture is adept at supporting multimedia and swiftly rendering maps, offering an unparalleled user experience. It enables users to make clear and informed decisions regarding network routing and location modeling. These functions are resource-intensive due to the complex algorithms and calculations making them best suited for server-side execution. The system allows unlimited user access through server-side application methods and is built using a combination of PHP, JavaScript, XML, AJAX, and XHTML. For small and medium-sized enterprises (SMEs), this system can be integrated as a plug-in on their websites. This integration allows customers to use their web browsers to access the suggested system application and perform essential tasks online. The plug-in extends the browser's capabilities, significantly enhancing the map client. Provides users with the tools to edit, search, visualize, and alter the appearance of maps according to their needs. Essentially, when the browser retrieves data, it can activate a plug-in to facilitate these various functions [5]. This setup ensures a versatile and user-friendly interface, making it an effective solution for businesses seeking to optimize their operational efficiency.

3.2. Smartphone platform

Desktop and mobile platforms are designed with a similar structure to ensure a consistent user experience. On mobile devices, web browsers act as the client-side component. These browsers are essentially the interface that users interact with; they display maps, showcase the results of GIS analysis, and receive GPS data from the user's device on the server side, where the client communicates with hosts for several critical functions [32]. It supports an e-commerce platform for users to engage in transactions, a web service that facilitates data exchange, and modules responsible for transforming GPS coordinates and performing other GIS-related operations. These server-side components process requests and information from client-side browsers. The connection between the client (mobile or desktop browser) and the server is maintained through various client-server communication networks. These networks ensure that the GPS receiver on the user's device can reliably transmit data to the map server. To accommodate a broad range of users with different types of internet access, the system supports both traditional connections like ADSL and dial-up as well as more modern wireless technologies such as Wi-Fi, WiMAX, and fiber optic. This inclusive approach ensures that users can access and utilize the platform's features smoothly, regardless of their internet connection type.

3.2.1. System users

The main users of this system are registered online shoppers, primarily using it for their e-commerce needs. Following them are e-retailers, especially small and medium-sized businesses (SMEs), who integrate this system into their websites as a subsystem to enhance their operations. In addition, logistics firms, particularly those that work with stores without their delivery fleet and rely on third-party logistics (3PL) providers, can also develop and use applications tailored to this system to streamline the transport and delivery of customer orders [5].

3.2.2. System functions

This system has two main parts: the front end and the back end. Customers use the front-end module that makes the desktop and mobile phone platforms. As the system administrator, the retailer intends to use the back-end module to handle logistics operations such as route planning and scheduling. The functional architecture of the system is shown in Figure 2. Figure 2 illustrates the system structure that has been developed for the management of the delivery process by retailers and customers' desktop and smartphone platforms. The following is an explanation of this structure:

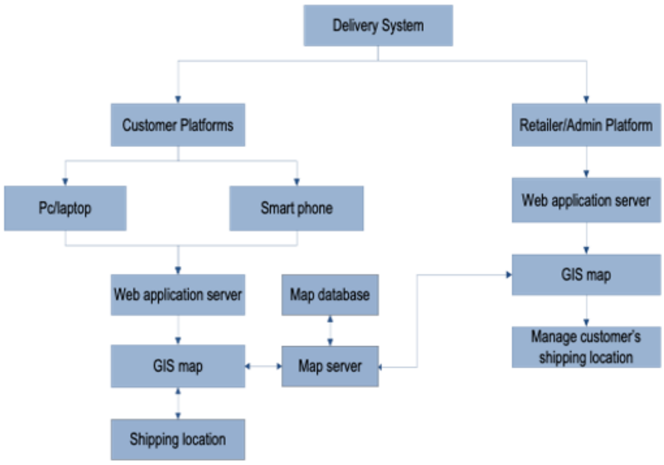

Figure 2. The designed system functional structure

3.2.3. The front-end module

When making an online purchase, PC and laptop users can confirm their shipping address, be it their home or office, to streamline delivery. After registering on a shopping website, the site shares the customer's address with the retailer. The e-commerce platform provides a map where users can pinpoint and mark their location, along with fields to enter their phone number, street, and neighbourhood details. This ensures that businesses or delivery services have the precise coordinates to accurately locate the customer's address [5].

3.2.4. Customers' smartphone platform

The smartphone platform is a critical component of the mobile-friendly e-commerce experience, as it replicates all the features found in the PC version. The user's precise location is determined and displayed on a map by utilizing the phone's built-in GPS. Nevertheless, desktop users are required to manually position a marker on the map after utilizing the search function to locate the closest street to their address [32].

3.2.5. The back-end module

The smartphone platform is a key part of the mobile-friendly e-commerce experience, mirroring all features found in the PC version. It utilizes the phone's built-in GPS to pinpoint and display the user's exact location on a map. However, desktop users need to manually place a marker on the map after finding the closest street to their address using the search function [32].

3.2.6. Electronic map

The map serves as a crucial tool for the system administrator, allowing them to retrieve and view client shipping addresses from the server. This enables the administrator to plan delivery routes and set precise delivery times for orders. By marking a residence on the electronic map, the system captures its coordinates, aiding in route planning and scaling. Users have the option to view the map at various zoom levels and switch between satellite and hybrid views for better clarity. Efficiently organizing and scheduling driver routes is essential ensuring prompt and accurate delivery of products to clients' homes [5].

3.2.7. Server-side functions

The server acts as the central hub in this system, using a client/server (C/S) architecture to facilitate interaction and data exchange between desktop/mobile users and retailers/logistics companies. Registered customers, on desktop or mobile, can provide their location details during the e-commerce checkout process. This information, once given to the system administrator, is stored in the user's account for future transactions. Existing customers also have the convenience of altering their shipping address with just a click, making it easy to update the destination for their purchases.

3.2.8. System model

The new system will enable customers to identify their houses on the map and allow the delivery courier to plan and schedule the route between the depot location and the customer's house location. The system flowchart contains the input and output parameters required to run the system. The outputs of this system are the system's main aim, which is the final destination location for the delivery courier. The designed system flowchart model is shown in Figure 3.

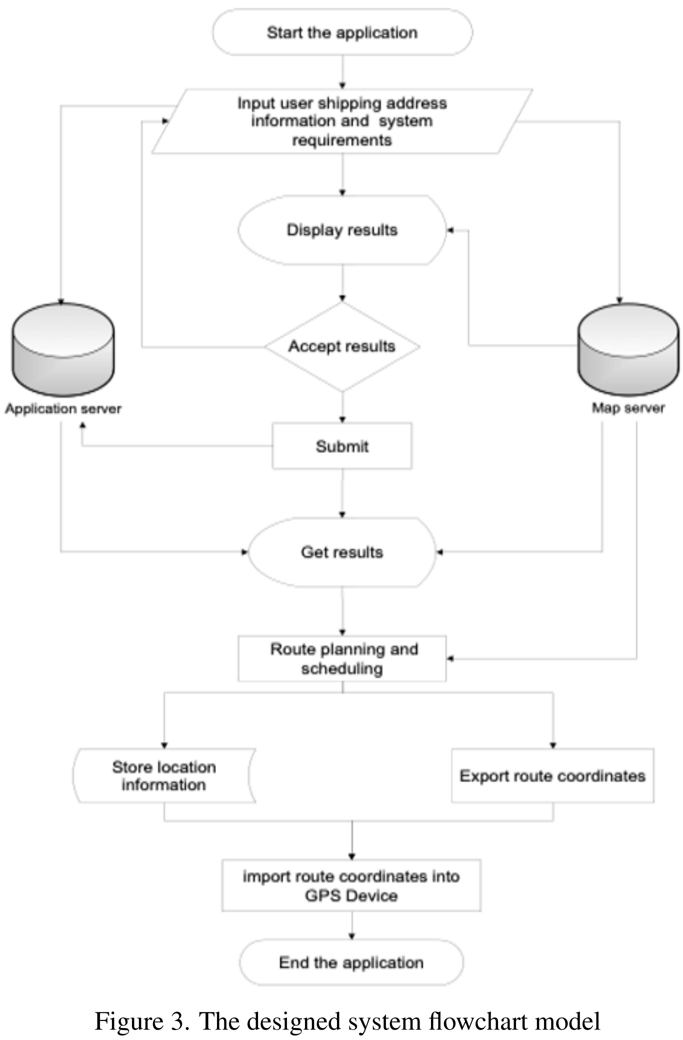

Figure 3. The designed system flowchart model

4. METHOD

This research study adopts a quantitative experimental design to systematically assess and compare the reliability and usability of the designed software application in this study. Researchers for data collection frequently employ this method as it provides a better understanding of the research problem, relying on surveys, observations, and interviews. Depending on the study's objectives, questionnaires are the most widely used method for the exploration, description, and explanation of the research problem. The survey's exploration objective is to comprehend the topic and its concepts in greater depth to determine the most important concepts and how to measure them [33]. This study used a survey questionnaire to determine customers' viewpoints towards online shopping and home delivery services in Jordan.

4.1. Sample

University students and academics, retailer employees, and delivery companies' employees have been found as the most frequent users of the Internet to perform daily activities, including online shopping. Albayati [34] and Barus [35] argues that they represent a large portion of online shopping as they buy personal items such as clothes, food, and entertainment products through the internet, as shown in Table 1.

Table 1. Participants experience with the Internet and smartphones

Internet usage	Usage period	Percent
Internet use	Daily	89.2
	Weekly	12.0
Smartphone use	Always	92.2
	Sometimes	6.0
	Never	1.8
Internet on smartphone	Yes	96.4
	No	3.6
Internet experience	Excellent	86.2
	Good	12.0
	Fair	1.8

Table 1 illustrates how participants used the internet in their daily activities. Most of the participants, 89.2%, use the internet daily, and 12% use the internet weekly. Most participants who used smartphones in their daily lives were 92.2% using smartphones often, 6% sometimes, and 1.8% never using smartphones. In addition, the percentage of participants who use the internet on their smartphones was 96.4%, and 3.6% do not use the internet on their smartphones. The internet use experience level frequency was 86.2% excellent, 12% good, and 1.8% fair experience. The questionnaire was disseminated to 250 individuals from various universities, retail stores, and delivery companies in Jordan via WhatsApp, email, and Facebook groups. The response rate was approximately 71%, as 167 questionnaires were returned and deemed valid for analysis. The study's convenient design, which required only 5-10 minutes to complete, was responsible for the high response rate.

4.2. Data collection procedure

Data were collected through quantitative research methods using a structured questionnaire based on an interval scale. The questionnaire consisted of four sections, including demographic data, usability factors, adoption factors, and system relative advantages. The questionnaire was pre-tested with experienced people to enhance its validity by evaluating each item's clarity and meaning and suggesting improvement areas. The study employed descriptive analysis to test the mean (M) and standard deviation (SD) for the variables and their items. Subsequently, POST HOC and ANOVA were utilized as analysis techniques to test the questionnaire items. Moreover, the questionnaire aimed to elicit the participant's viewpoint when using multiple-point responses, such as the Likert scale, in a distributed questionnaire. The objective of the questionnaire is to investigate the situation, attitude, and perception of the respondents in a population or subgroups about the services provided. The objective of the explanation of the survey is to test the theory and causal relations by identifying the relationship between the variables [33], [36]. To respond to these items, the questionnaire was distributed to four categories of respondents: employees, managers, consultants, and university professors with academic and industrial backgrounds, as shown in Table 2.

Table 2. Participants' demographics

Demographic profile	Category	No. of participants	Percentage	Total
Gender	Male	131	78.4	167
	Female	36	21.6	
Age range (years)	18-28	46	27.5	167
	29-49	95	56.9	
	50-60	26	15.6	
Education level	Ph.D.	29	17.4	167
	MSc.	35	21.0	
	BSc.	101	60.5	
	GCSE	2	1.2	
Job title	Retailer	31	18.6	167
	Delivery employee	59	35.3	
	Students and academic staff	77	46.1	

Table 2 shows that men made up 78.4% of the participants and women 21.6%. 56.9% of the participants were between the ages of 29 and 49, 27.5% were between the ages of 18 and 28, and 15.6% were between the ages of 50 and 60. Also, 60.5% of the participants hold a B.Sc. 21% hold M.Sc. 17.4% hold Ph.D., and 1.2% hold a GCSE. Finally, there are three distinct types of participants based on their occupations: 46.1% students and academic staff; 18.6% retail employees; and 35.3% delivery logistics workers.

5. RESULTS AND DISCUSSION

We conducted the investigation and analysis to evaluate the system's usability for both customers and retailers. This includes the ease of use for customers to search on both platforms and select shipping addresses, as well as for retailers to find customer house locations, generate routes, and export/import route information. Furthermore, the system's relative benefits, including resolving home delivery issues and enhancing trust and satisfaction with online shopping, along with adoption factors like willingness/satisfaction and recommendations for others, have been considered crucial for its validation. Group 1 (G1) consisted of individuals employed in retail; Group 2 (G2) of individuals employed in delivery logistics; and Group 3 (G3) of individuals employed in higher education institutions.

5.1. Usability factors for customers

Table 3 shows each group's average scores on various usability metrics, such as the ease of choosing shipping addresses and conducting searches on desktop and mobile devices. The mean (M) and standard deviation (SD) scores for the usability factor attained by the participants in the three groups are shown in Table 4. Furthermore, post hoc analysis (POST HOC) and analysis of variance (ANOVA) were implemented to evaluate the participants' perspectives on the efficacy of the proposed system.

Table 3. Mean and standard deviations of usability factors for customers

Factor		G1	G2	G3
Ease of use for search using desktop	M	1.35	1.05	1.13
	SD	0.608	0.222	0.338
Ease of use for search using the smartphone	M	1.32	1.10	1.26
	SD	0.599	0.443	0.637
Ease of use for selecting a shipping address	M	1.32	1.10	1.19
	SD	0.599	0.357	0.430

Table 4 shows the results of the ANOVA test, which indicates a statistically significant difference between the groups regarding search usability on the desktop platform ($P = 0.0010 < 0.5$). There are also no statistically significant differences between the groups in terms of searching using the smartphone platform ($P = 0.143 > 0.05$) or changing the delivery address from the saved address list in the customer's account ($P = 0.081 < 0.05$).

Table 4. ANOVA results of usability factors for customers

Factor	F	Sig.
Ease of use for search using desktop	6.899	0.001

Table 5 shows the desktop search usability results after performing POST HOC analysis. There were statistically significant differences between the three groups in how easy they thought the desktop platform search was to use. This suggests that the desktop platform house search is seen as a little more difficult and may require some digital map experience. The customer will manually identify the location of the house on the map using a desktop platform. However, most people already know how to use desktop applications, so searching for house locations on a map is easy. In addition, the size of desktop monitors made it easier for users to manipulate the map's zoom in and out and view settings (i.e., hybrid and satellite views). Finally, the mouse cursors make it simple and convenient to move the map marker to the desired location [37]. When searching for and identifying the location of the houses on the map using a smartphone platform, there are no statistically significant differences between the groups. However, a GPS receiver is built into the smartphone to facilitate automatic location detection [32]. Finally, after the initial use of the system, there is no statistically significant difference between the groups regarding the ease of selecting the shipping address. This shows that the system is user-friendly because it allows users/customers to save their shipping address after identifying it on the map. This makes identifying the shipping address easy and stress-free for future online purchases. Furthermore, the system lets users choose an alternate shipping address, pin it to a map, and use it instead of the saved addresses (for example, work).

Table 5. POST HOC results of usability factors for customers

Factor	Group	Other groups	Sig.
Ease of use for search using desktop	G1	G2	0.001
		G3	0.014
	G2	G1	0.001
		G3	0.438
	G3	G1	0.014
		G2	0.438

5.2. Usability factors for retailers

Table 6 displays the average scores of each group on various usability measures, including the ease of locating a customer's home location on a map, creating a route, and exporting and importing routes. Table 6 also displays the data on usability achieved by participants in the three groups, along with their respective M and SD. The participants' thoughts on the usability of the proposed system were also analysed using ANOVA and POST-HOC testing.

Table 6. Mean and standard deviations of usability factors for retailers

Factor		G1	G2	G3
Ease of use for finding customer's house location	M	1.29	1.08	1.19
	SD	0.588	0.281	0.488
Ease of use for route generating	M	1.61	1.27	1.45
	SD	0.844	0.665	0.804
Ease of use for route information export/import	M	1.45	1.41	1.19
	SD	0.768	0.812	0.460

According to ANOVA test results, finding customers' homes was not significantly different between the groups ($P = 0.104 > 0.05$). There are also no statistically significant differences between the groups in terms of the ease of creating search routes ($P = 0.117 > 0.05$). Finally, there are no statistically significant differences between the groups in terms of the ease of exporting route information from the map and importing it into a GPS receiver to obtain the necessary directions to the desired destination ($P = 0.086 > 0.05$). There is no statistically significant difference between the groups in the POST HOC results to facilitate use in locating customers' homes. Since there are currently no such systems in Jordan, this indicates the efficiency and accuracy of finding residential addresses. Having a delivery system that can pinpoint the customer's address also improves the effectiveness and efficiency of the delivery operation. This conforms to the findings of [10], [38], [39]. At the same time, there is no statistically significant difference between the groups regarding map-based route generation simplicity, suggesting that retailers can use the system to plot delivery routes from the depot to their customers' homes easily. Furthermore, there is no statistically significant difference between the groups in terms of the simplicity with which retailers can export route information from the map and import it into the GPS receiver, indicating that the system allows retailers to do so. According to Wahab *et al.* [10] and Buzzega and Novellani [1], delivery service providers can better serve their customers by speeding up their products' delivery and improving the system's management efficiency [40].

5.3. Adoption factors

Predictive factors for system adoption include user willingness/satisfaction and the likelihood of users recommending the system to others. We researched the factors that lead to software adoption to verify the new system. Adoption factors, such as willingness and recommendation for the use of such a system, have mean values for each group shown in Table 7. In addition, ANOVA and POST HOC analysis were used to assess the participants' perspectives on the adoption factors of the proposed system.

Table 7. Mean and standard deviations of adoption factors

Factor		G1	G2	G3
System usage willingness on desktop	M	1.94	1.97	1.90
	SD	0.359	0.183	0.347
System usage willingness on the smartphone	M	2.13	1.85	1.79
	SD	1.05	1.09	0.864
System usage recommendations on desktop	M	1.29	1.08	1.23
	SD	0.529	0.337	0.605
System usage recommendations for smartphone	M	1.32	1.12	1.23
	SD	0.599	0.560	0.583

According to the ANOVA analysis results, there are no statistically significant differences between the groups concerning desktop platform system usage willingness ($P = 0.405 > 0.05$). The willingness to use the system on the smartphone also indicates that there are no significant differences between the groups ($P = 0.270 > 0.05$). On the desktop platform, there are also no statistically significant differences in system usage recommendations between the groups ($P = 0.122 > 0.05$). The groups' recommendations for system usage on smartphone platforms, however, do not differ statistically significantly ($P = 0.252$). There were no significant differences between the groups in how likely they were to use the system on a desktop platform after the fact. This data suggests that the participants are okay with the idea of the system keeping track of their home addresses in the future. At the same time, there are no statistically significant differences between the groups in terms of willingness to use the system on a smartphone. This suggests that the participants are okay with the idea of using the new system as a smartphone platform or app to automatically find their home in the future. There are also no statistically significant differences between the groups on the recommendation of system usage on the desktop for others, indicating that participants advise others to use the system to identify their house location when shopping online on the desktop platform. Currently, there are no statistically significant differences between the groups recommending the system as a smartphone platform. This means that participants recommend the new system to others (e.g., smartphone users) to use the new system to identify their home location when shopping online. These findings are in line with the results of Wahab *et al.* [10] and Abousaeidi [41].

5.4. System relative advantages

The survey gathered participant opinions to determine whether the new system could enhance online shopping by increasing trust and satisfaction and address home delivery issues such as a lack of a postcode system and a lack of a routing and scheduling system to test the validity of the new system's potential to address these issues. However, Table 8 presents the mean values of improving online shopping, trust and satisfaction, and solving home delivery problems for each group.

Table 8 shows the M values and SD for the participants' usability in the three groups. Further, ANOVA and POST HOC analysis were conducted to determine the participants' opinions to see if the new system will help improve online shopping, trust, and satisfaction and solve home delivery problems. The results of the ANOVA analysis are presented in Table 9, and the results of the POST HOC analysis are shown in Table 10. As shown in Table 9, the ANOVA analysis results indicate no statistically significant differences between the groups in terms of solving the home delivery problem for both customers and retailers ($P = 0.103 > 0.05$). Simultaneously, there are statistically significant differences between the groups in improving online shopping trust and satisfaction among customers and retailers ($P = 0.006 < 0.05$). The results are consistent with the results of [7], [39], [42], [43]. Table 10 shows POST HOC results for improving online shopping, trust, and customer satisfaction. There were statistically significant differences between G1 and G2 in how well online shopping, trust between customers and retailers, and customer satisfaction were improved. This means that everyone in both groups was happy with the results, which are in line with [7], [44], and [45].

Table 8. Mean and standard deviations of improving online shopping and solving delivery problems

Factor		G1	G2	G3
The new system will help in solving the problem of home delivery	M	1.39	1.14	1.34
	SD	0.615	0.507	0.718
The new system will help in improving online shopping, trust, and satisfaction	M	1.35	1.07	1.17
	SD	0.608	0.254	0.377

Table 9. ANOVA results for improving online shopping and solving delivery problems

Factor	F	Sig.
The new system will help in solving the home delivery problem	2.302	0.103
The new system will help in improving online shopping, trust, and satisfaction	5.358	0.006

Table 10. POST HOC results of improving online shopping and solving delivery problems

Factor	Group	Other groups	Sig.
The new system will help in improving online shopping, trust, and satisfaction	G1	G2	0.004
		G3	0.072
	G2	G1	0.004
		G3	0.305
	G3	G1	0.072
		G2	0.305

6. CONCLUSION

This study introduced a web GIS-based system to improve home delivery service in Jordan, where the lack of a postcode system creates major challenges. The system allows users to accurately mark their home location on a map, making deliveries faster and more reliable. Results show high acceptance and satisfaction from customers and retailers, specifically when using smartphones. The system reduces delivery time and costs, improves trust in online shopping, and supports local e-commerce. While the study was limited to urban areas and a small sample of participants, the findings highlight strong potential for wider adoption and future improvements, such as better integration with third-party delivery services.

ACKNOWLEDGMENTS

We are deeply grateful to Al Zaytoonah University of Jordan and University of Petra for their assistance. The institution's dedication to instruction, research, and social involvement has improved our education understanding. We appreciate the ZUJ and UOP support of our efforts in scientific research.

FUNDING INFORMATION

The authors state that no funding is involved.

AUTHOR CONTRIBUTIONS STATEMENT

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
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Ahmad Nabot	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Bilal Sowan		✓		✓		✓	✓		✓		✓	✓		✓

C	: **C**onceptualization	I	: **I**nvestigation	Vi	: **Vi**sualization
M	: **M**ethodology	R	: **R**esources	Su	: **Su**pervision
So	: **So**ftware	D	: **D**ata Curation	P	: **P**roject Administration
Va	: **Va**lidation	O	: Writing - **O**riginal Draft	Fu	: **Fu**nding Acquisition
Fo	: **Fo**rmal Analysis	E	: Writing - Review & **E**diting		

CONFLICT OF INTEREST STATEMENT

The authors state no conflict of interest.

DATA AVAILABILITY

The data that support the findings of this study are available on request from the corresponding author, [A. Nabot]. The data, which contain information that could compromise the privacy of research participants, are not publicly available due to certain restrictions.

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