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Smart accommodation solution: innovative boarding house locator in Bayombong municipality

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ABSTRACT

The search for affordable and conveniently located student accommodation is a common challenge, especially for students unfamiliar with their surroundings. This study presented the development and evaluation of a geographical information system (GIS)-enabled boarding house locator developed for Nueva Vizcaya State University (NVSU) students. The platform simplified the accommodation search process by providing a digital solution that integrates spatial data, real-time updates, and filtering options. The platform significantly reduced the time and cost of traditional housing searches. It helped students save 181.25 minutes per search and an average of 35 PHP in transportation costs compared to conventional methods like physical visits and word-of-mouth. Usability testing with 175 participants revealed high satisfaction, with the platform receiving an average rating of 4.83 for usability and 4.75 for performance. Key features such as interactive maps, location-based searches, and real-time updates enhanced the user experience by providing accurate, and up-to-date listings. The GIS-based platform outperformed traditional search methods in terms of efficiency and user satisfaction and offered a digital solution to common housing challenges faced by students. The results suggested the platform had strong potential for wider application at other universities. Overall, this system provides a scalable, cost-effective solution to improve student accommodation search and management.

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1. INTRODUCTION

The most significant milestone for every student is choosing the right state universities and colleges that offer a quality education. Students who are from far-flang areas are to find the most suitable accommodations that are affordable and conveniently located near the university or colleges they have chosen. Boarding houses with shared accommodations and shared communal facilities like bathrooms, laundry, and kitchen areas serve as the second home for students. Also, these properties provide a secure environment away from family, which is most important to students' well-being. Many students now consider housing to be a crucial necessity, especially for students studying away from home. Students whose residences are located far from their schools may choose to rent nearby boarding houses to save time and energy on commuting, while others may opt for boarding houses as temporary housing [1].

The challenge for students of finding suitable housing near their universities is always accompanied by time, money, and effort [2]. This concern is always encountered by students who are new in the area and lack of knowledge in the location of local boarding houses. Several students have difficulties and are confused in looking for a safe and comfortable place to stay such as boarding houses [3]. Students can get information about boarding houses by searching door to door, asking acquaintances in the community, and looking at posted brochures from nowhere. These methods are claimed to be ineffective because they will waste more time and energy and could even damage the environment. However, locating an appropriate boarding house can be a significant challenge, especially for students who are unfamiliar with the local area [4]. Nowadays, students from far-flang areas and distant regions in the country always take into consideration in selecting accommodation proximity and affordability [5], however, locating accommodations that meet these criteria, requires a lot of time, money and effort, especially for students from distant regions [6].

In locating boarding houses, students always choose to make a house-to-house tour of nearby universities or rely on word-of-mouth recommendations to identify suitable boarding houses [7]. This method is cumbersome, especially for students from distant regions, who may struggle to locate the local housing market or identify where to inquire about available options. As a result, the search for suitable accommodation can become a barrier to academic success and overall well-being [8]. Locating boarding houses or suitable accommodations with the aid of boarding house search applications or digital platforms, students can easily locate desired accommodations [9].

The group of Guntur *et al.* [10] highlights that the majority of boarding house owners continue to depend on traditional marketing methods to promote their properties, particularly by using signs that say 'Boarding House' in front of their houses. In promoting boarding house options, offering both convenience and wider reach for all parties involved, there is a growing need for a digital platform [11]. In the digital age, the Internet provides accessible and reliable information, an efficient tool for services and transactions in the boarding house industry [12]. While several online platforms assist in finding housing, most are geared toward long-term rentals or property sales rather than short-term accommodations suited to students. Platforms like HotPads [13], [14], PadMapper [15], and Trulia [16] primarily cater to apartment rentals or home sales, while services like Trivago, Zumper, and Housing.com target tourists or those seeking permanent homes. In the Philippines, platforms such as Lamudi [17] and MyProperty [18] focus on residential properties, but they are not tailored to students' specific needs for temporary, affordable, and conveniently located accommodations.

In Bayombong, Nueva Vizcaya, home to major educational institutions, including Nueva Vizcaya State University (NVSU), PLT College, Inc. (PLTC), and Saint Mary's University (SMU)-students face similar housing challenges. NVSU, with its main campus in Bayombong and a satellite campus in Bambang, serves a growing student population from diverse regions such as Quirino, Isabela, Nueva Ecija, and Ifugao. According to the latest enrollment data, NVSU's main campus hosts 9,579 students, with numbers expected to rise in the coming years. This increase in student population, combined with limited and often inadequate housing options, underscores the need for a more efficient way to help students locate suitable accommodations.

The Commission on Higher Education's (CHED) CMO 9 of 2013 mandates that universities support students in securing safe, affordable, and accessible housing [19]. In response, NVSU has acknowledged the importance of providing mechanisms that facilitate this process, recognizing that access to suitable housing is crucial for students' academic success and well-being.

To address the above-mentioned challenges, this study proposed the development, implementation, and evaluation of a geographical information system (GIS)-based boarding house locator, a web-based platform that assists NVSU students in efficiently locating, comparing, and reserving boarding houses and apartments in the nearby university. The platform features an interactive map with route directions, allowing students to easily locate available accommodations. It provides detailed information on each listing, including descriptions, images, prices, and proximity to campus. The platform allows boarding house owners to update their listings and track barangay business permits to ensure compliance with local housing standards. By utilizing the GIS, this solution offers a user-friendly, spatially integrated platform [20]-[22] that significantly reduces the time and effort students spend searching for accommodation, ultimately enhancing their overall university experience.

2. RESEARCH METHOD

This section outlines the chronological research design, the procedures followed, the algorithm used for the web-based platform the GIS-based boarding house locator, and the data acquisition process, development, testing, and evaluation procedures. The research was carried out in several stages, including system design, development, testing, and data collection, as described below.

2.1. Research design

The study employed design and development methodologies to develop a web-based platform that utilized GIS that enabled students from far-flung areas and distant provinces to search, assess, and book suitable boarding houses in the vicinity of their university efficiently. The system design involved multiple components such as a friendly user interface, a spatial database, a GIS mapping tool, and an administrative panel for boarding owners, visitors, local government unit staff, and web administrators.

The primary objective was to create a web-based platform that would provide students with an engaging spatial interface so that locating appropriate accommodation takes less time, less money, and less effort [23]. This system provides detailed information on boarding houses, including their proximity to the university, prices, availability, and other relevant factors that students might consider in getting their boarding house. Tenants will be interested in this approach since it would be simpler for those looking for a boarding house to obtain the necessary boarding house specifications [24].

2.2. Research procedure

The research procedure could be divided into several key phases, as shown below:

a. Phase 1: system design

The developed system was designed using a client-server architecture as shown in Figure 1, where the client side (student/visitor, boarding house owner, barangay unit staff, and NVSU administrators) would interact with the servers hosting the GIS database and web services. The developed web-based application contained the following components:

- Frontend: developed using HTML5, CSS, JavaScript, and Leaflet.js [25] (for GIS mapping).
- Backend: the backend was powered by Node.js and Express for the web server, with MySQL for the database to store boarding house information.
- GIS integration: Leaflet.js, an open-source JavaScript library for interactive maps, was used to visualize boarding house locations based on geographical data.

Figure 1 is the architectural design for the developed system:

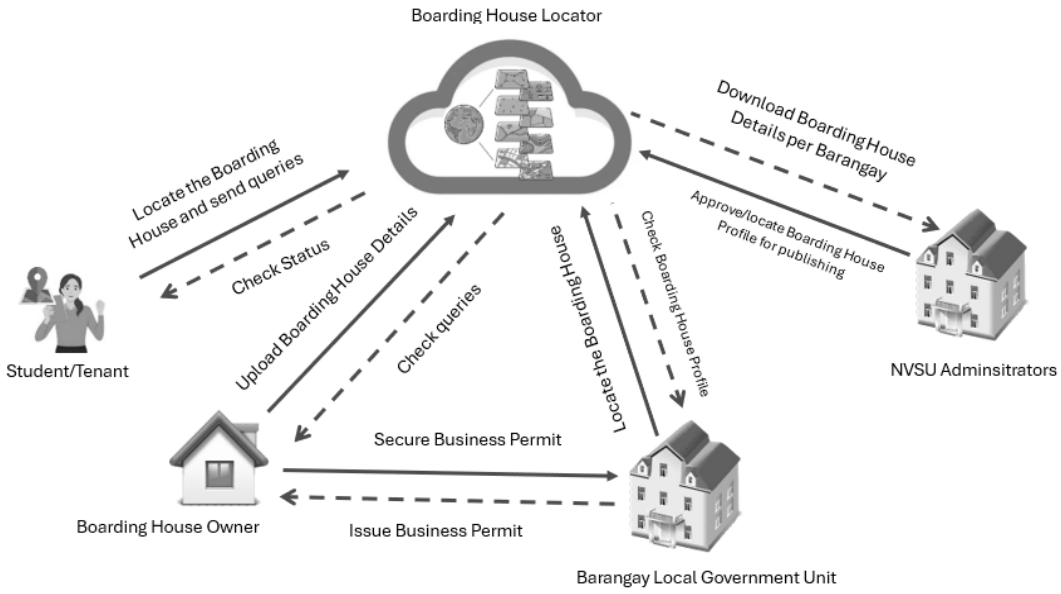

Figure 1. System architectural design

Figure 1 shows the system's architectural design. The boarding house locator was a GIS-based platform designed to simplify searching for and managing boarding house accommodations near universities. Aimed at addressing the needs of students, boarding house owners, Barangay Local Government Units (BLGUs), and university administrators, the system provided an interactive, map-based interface. Students could easily search for accommodations based on their preferences, such as proximity to the university, price, boarding house type, search by barangay, and availability, helping them make informed housing decisions.

Nowadays, the boarding house industry is expanding rapidly, and entrepreneurs look at certain factors that will help achieve this growth. The use of technology like marketing via the Internet, payment systems, and business applications for managing boarding houses helped improve the efficiency of the operations and management of the businesses [26]. Additionally, modern information technology has also impacted nearly every aspect of human life [27]. Thus, the developed web-based platform provided an easy-to-use interface for the boarding house owners to manage their property details and tenant information, including room availability, pricing, and contact details. Owners could track all inquiries from students, update the status of rooms, and respond to queries in real-time. The centralization of the platform ensured that only verified and up-to-date information was available to students while enhancing the efficiency of managing properties and communicating with potential tenants.

The developed web-based platform provided tools to monitor and regulate boarding houses within BLGUs jurisdiction. BLGU officials could access detailed profiles of boarding houses, track business permit statuses, and check their records to see if the boarding house had approved permits through the platform. This feature promoted regulatory compliance and enhanced local oversight of housing options. University administrators also participated in the system by verifying boarding house details for publishing on the platform. Administrators could analyze data on boarding houses across different barangays to help make informed decisions about student accommodations.

Generally, the web-based boarding house locator fostered greater transparency, efficiency, and accessibility in managing student housing. Offering accurate, real-time information for students, streamlining property management for owners, and enabling regulatory oversight by BLGUs and university administrators, the platform improved the organization and management of local accommodations. It also had the potential for broader applications in other urban areas and offered a scalable solution to housing challenges.

b. Phase 2: algorithm and pseudocode

The main core of the developed system was the boarding house search algorithm, which matched the user queries such as proximity to campus, price range, and type of rooms [28]. The designed algorithm also allowed boarding house owners to update dynamically boarding house information or details such as price, number of rooms, and tenant to ensure that the system reflected the most accurate data available.

The simplified pseudocode representation of the search algorithm:
Algorithm: Search_Boarding_House (*location, priceRange, barangay, bh_type*)
Input: User's current location, desired price range/barangay/type
Output: List of available boarding houses sorted by proximity

1. Initialized an empty list of results.
2. For each boarding house in the database:
    a. Displayed the user's location and the boarding house using GIS.
    b. If the criteria (search by location, barangay, price_range, bh_type) matched:
        i. Added the boarding house to the result list.
3. Sorted the result list by proximity.
4. Return the sorted list to the user.

c. Phase 3: data acquisition

Data acquisition involved two primary steps:

1. Boarding house data collection: boarding house owners were surveyed to provide their accommodation details, including descriptions, images, prices, and other relevant information. This data was stored in a MySQL database for dynamic querying.
2. Geographical data: GIS data (e.g., coordinates of the university and boarding houses) was obtained using Leaflet Maps API and other publicly available geospatial datasets to provide accurate mapping.

d. Phase 4: development

The software development methodology was implemented to guide the creation of the platform. The Agile Scrum methodology was chosen for its flexibility and iterative approach, which allows for continuous feedback and improvements. Dingsoeyr *et al.* [29] asserted the software development process was transformed by the agile technique, which emphasizes adaptability, active end-user contact, and progressive product delivery. Its purpose was to help developers manage complex projects that address the gap between customer needs and development and testing teams. This methodology facilitated the incremental development of the platform, ensuring that it could evolve based on user needs and feedback throughout the development process.

To model the system, this study used the use case diagram, which served as the blueprint for development. According to Aleryani [30], a use case diagram is a visual depiction that illustrates how a system is utilized, describing the typical interactions between users and the system. The system prototype was then built using XAMPP for local hosting, MySQL for the backend, and for the front-end PHP for dynamic scripting, HTML5, JavaScript, Bootstrap, and Leaflet.js an open-source JavaScript Library for interactive maps. The system was rigorously tested as stated in Phase 5. After meeting the client's requirements, the system was deployed in a live online environment. Throughout the development, the researchers iteratively gathered feedback, reviewed progress, and made necessary adjustments to address challenges.

e. Phase 5: testing

The testing was performed in two main stages:

1. Unit testing: each component of the system was tested independently to ensure it functions as expected (e.g., map integration, user input handling, database queries).
2. User testing: a group of NVSU students, boarding house owners and IT experts in web application development participated in usability testing. They used the platform to search for boarding houses and provided feedback on the user interface, functionality, and overall experience. Adjustments were made based on their feedback to improve usability.

Testing was conducted to ensure the platform met the following criteria:

1. Performance: the platform loaded quickly and displayed results in real-time.
2. Compatibility: the platform functioned correctly across different devices, browsers, and operating systems.
3. Usability: the platform was easy to use and navigate.
4. Reliability: the system consistently provided accurate and up-to-date boarding house information based on user queries.
5. Portability: the platform could be easily deployed and adapted across different environments and systems.

2.3. Data analysis

The effectiveness of the GIS-based boarding house locator was evaluated through both qualitative and quantitative methods:

- Usability feedback: collected through surveys and interviews from users, focused on their satisfaction with the platform's ease of use, functionality, and relevance of results.
- Performance metrics: response times, accuracy of location matching, and overall system stability were measured during testing.

The Figures and Tables illustrate key components of the system and the testing results. Figure 2 shows the boarding house interactive map locator, which allows users to view all available boarding houses in the vicinity of Nueva Vizcaya State University.

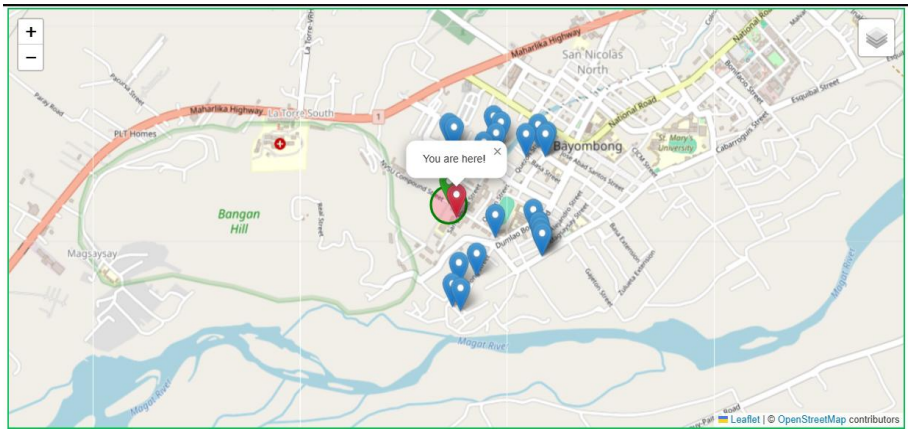

Figure 2. The interactive map displays boarding house locations near NVSU

On the other hand, Figure 3 shows the boarding house interactive map location with route direction, which allowed users to view details about the selected boarding house as well as the distance between the user and the chosen boarding house on the map. Figure 4 shows the filtering feature of the boarding house locator, which allows the users to filter by price range, by barangay, by boarding house type. Table 1 shows

the computation to compare the time taken between the traditional method and using the GIS-based platform. Table 2 shows the system summary test result using the following criteria: performance, compatibility, usability, reliability, and portability.

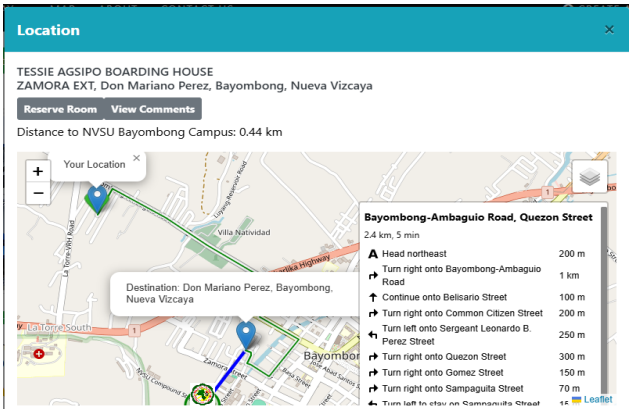

Figure 3. Screenshot of the interactive map displaying selected boarding house with direction path

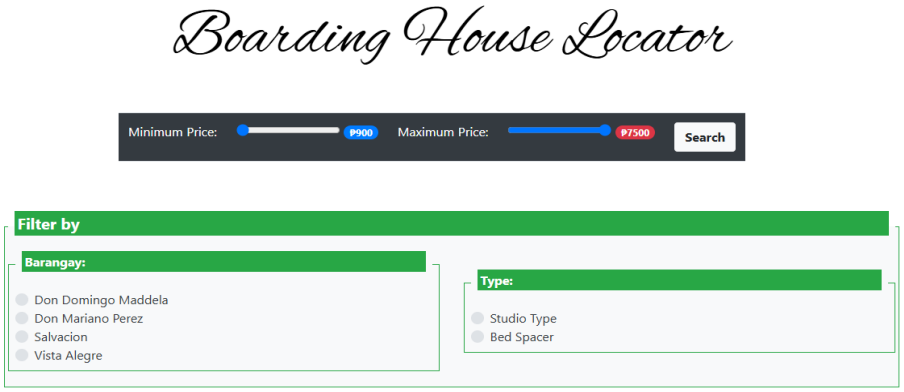

Figure 4. User interface showing filtering options

Table 1. Comparison of the time taken to find a suitable boarding house using traditional methods (e.g., visiting neighborhoods) vs. using the GIS-based platform

Barangay Near NVSU Bayombong Campus	Barangay Near NVSU Bayombong Campus	Barangay Near NVSU Bayombong Campus	Barangay Near NVSU Bayombong Campus	Barangay Near NVSU Bayombong Campus	Barangay Near NVSU Bayombong Campus	Barangay Near NVSU Bayombong Campus
Don Domingo Maddela	2 hr 30 min	1min	2 hr 29 min	50 PHP	2.5	4.8
Don Mariano Perez	1 hr 45 min	2min	1 hr 43 min	30 PHP	2.7	4.9
Salvacion	3 hr 25 min	1min	3 hr 24 min	60 PHP	3.0	4.7
Vista Alegre	4 hr 30 min	1min	4 hr 29 min	80 PHP	2.8	4.9
Average	2 hr 59 min (179 min)	1min	2 hr 58 min (178 min)	55 PHP	2.75	4.825

Table 2. Summary of the test result conducted

No.	Indicators	Category mean	Qualitative description
1.	Performance	4.75	Strongly agree
2.	Compatibility	4.66	Strongly agree
3.	Usability	4.83	Strongly agree
4.	Reliability	4.92	Strongly agree
5.	Portability	4.92	Strongly agree
	Mean	4.89	Strongly agree

3. RESULTS AND DISCUSSION

This section presents and interprets the findings of the study in relation to the objectives set forth in the research. The results focus on the evaluation of the GIS-enabled web-based boarding house locator in terms of efficiency, effectiveness, usability, cost, and overall user satisfaction. Each subsection highlights the performance of the platform, compares it with traditional methods, and discusses the implications of the results in the context of related studies and practical applications.

3.1. Overview of platform performance

The GIS-based boarding house locator developed for the students of NVSU enhanced the efficiency and effectiveness of locating suitable accommodation near the university. With the help of the interactive web-based platform, the students could search, compare, and book boarding houses depending on geographical distance, and cost, among others. The findings of the study illustrated the utility of the platform to solve the issues and concerns that students often encounter in the search for low-cost and well-located accommodation.

3.2. Effectiveness of the GIS-based platform

The main goal of the web-based platform was to reduce the time and effort required for students to find suitable accommodations, especially for those unfamiliar with the local area. Aligning to this goal, Balla and Gede [31] asserted that web-based thematic maps are among the most popular tools for ensuring an overall data visualization of quantitative information. The results shown in Table 1, clearly indicated a substantial reduction in time spent finding accommodations.

3.2.1. Time savings

To derive the information presented in Table 1, the study involved participants and collected data from each barangay near the NVSU Bayombong Campus. The participants provided data based on their experiences with traditional and web-based methods. The time taken by each participant in traditional methods and a web-based system was recorded, as well as the cost incurred using traditional methods. In addition, the collected feedback from participants regarding their satisfaction with both methods and documented the cost they incurred using the traditional method.

On average, students using traditional methods (physically visiting neighborhoods or relying on word-of-mouth) took significantly longer to identify and evaluate boarding house options. The time difference was calculated in (1).

$$Time\ Difference = Time\ Taken\ (Traditional) - Time\ Taken\ (Web - based) \quad (1)$$

For instance, in Barangay Don Domingo Maddela, the time difference was computed in (2).

$$Time\ Difference = 2hr 30\ \text{min} - 1\ \text{min} = 2hr\ 29\ min \quad (2)$$

The time savings were consistent across all tested areas (Don Domingo Maddela, Don Mariano Perez, Salvacion, and Vista Alegre), where the GIS platform reduced the search time by more than (2) hours in most cases.

This formula was selected because it directly compared the time spent by students using traditional methods (physical visits or word-of-mouth) with the time spent using the web-based platform. The web-based platform was expected to reduce search time due to its use of GIS technology, filtered options, and access to real-time information. By calculating the time difference between the two methods, one could quantify the time savings the web-based platform provided and highlight its efficiency in locating boarding houses.

3.2.2. Average time comparison

The average time taken using traditional methods across all barangays was computed in (3).

$$\begin{aligned} Average\ Time\ (Traditional) &= \frac{(150\text{min} + 105\text{min} + 205\text{min} + 270\text{min})}{4} \\ Average\ Time\ (Traditional) &= \frac{(730\ \text{min})}{4} \\ Average\ Time\ (Traditional) &= 182.5\ min \end{aligned} \quad (3)$$

In contrast, the average time spent using the GIS-based platform was computed in (4).

$$Average\ Time\ (Web-based) = \frac{(1\text{min} + 2\text{min} + 1\text{min} + 1\text{min})}{4}$$
$$Average\ Time\ (Web-based) = \frac{(5\ \text{min})}{4} \quad (4)$$
$$Average\ Time\ \ (Web-based) = 1.25\ min$$

This illustrates that, on average, the GIS platform saved approximately 181.25 minutes per search.

The formula for average time was selected to clearly compare the time spent using traditional methods (such as physical visits or word-of-mouth) and the time spent using the web-based GIS platform. This formula is a standard method for calculating the mean of a dataset, and allowing the user to quantify the overall time savings for each approach.

3.2.3. Cost savings

The traditional method involved significant transportation costs due to the need for physical site visits. The cost difference could be calculated in (5).

$$Cost\ Difference = Cost\ of\ Traditional\ Method - Cost\ of\ Web-based\ Method \quad (5)$$

For example, in (6) the given formula, the cost difference in Barangay Don Domingo Maddela was:

$$Cost\ Difference = 50PHP - 20PHP = 30PHP \quad (6)$$

The average cost for the traditional method was calculated using in (7).

$$Average\ Cost\ (Traditional) = \frac{(50PHP + 30PHP + 60PHP + 80PHP)}{4}$$
$$Average\ Time\ (Traditional) = \frac{(220PHP)}{4} \quad (7)$$
$$Average\ Time\ (Traditional) = 55PHP$$

In comparison, the average cost of using the web-based platform was solved using in (8).

$$Average\ Cost\ \ (Web-based) = \frac{(20PHP + 20PHP + 20PHP + 20PHP)}{4}$$
$$Average\ Time\ \ (Web-based) = \frac{(80PHP)}{4} \quad (8)$$
$$Average\ Time\ \ (Web-based) = 80PHP$$

This results in an average cost saving of 35 PHP per search when using the web-based platform.

3.3. Usability and user experience

Feedback was collected from 175 respondents, including boarding house owners, students, barangay staff, and IT experts in web app development. Participants were selected through random sampling to ensure a representative sample. The data were collected using an online survey questionnaire designed to evaluate the platform. The questions addressed key quality characteristics, such as performance, compatibility, usability, reliability, and portability. The data were analyzed using SPSS, where the mean scores for each quality were calculated.

The usability feedback collected from the students at NVSU during the testing phase showed that the platform was very user-friendly, easy to navigate, and had an intuitive interface. Figures 2-4 show the interactive map, which was appreciated by all users. The students could see the available boarding houses and easily find the ones nearest to the university. Feedback from usability testing indicated that students found the platform easy to use, particularly the map-based navigation and filtering options. The fact that one could view more information about each listing- including images, description, and pricing was also a point of praise. Users expressed high satisfaction with the functionality of the platform in general, which resulted in a much easier process for searching for accommodations.

The developed GIS-based boarding house locator was evaluated on the criteria that included performance, compatibility, usability, reliability, and portability. A survey was conducted on 175 participants who included IT experts, owners, students, and BLGUs staff. The results in Table 2 showed that all the criteria were strongly met, especially on the reliability, and usability, which received the highest ratings (4.92). The platform was efficient in performance (4.75), and compatible across major modern browsers and devices (4.66). The usability received a rating of 4.83, with the users praising the intuitive interface, and portability also received a high rating of 4.92, which confirmed that the platform was adaptable to various

environments. The high compliance score across all categories underlines the effectiveness of the platform in delivering a reliable, user-friendly experience, more so in its GIS capabilities.

The GIS-based boarding house locator greatly enhanced the process of finding student accommodations in Bayombong. Addressing such critical challenges as the unavailability of up-to-date information, the absence of online mapping tools, and the difficulty in assessing accommodation quality, the platform enhanced the user experience for students and accommodation providers alike. Directly addressing the spatial challenges that students faced when searching for nearby accommodations, the platform's GIS capabilities included interactive maps and location-based searches. The results of user evaluation, especially the high ratings for reliability and usability, reflected the success of the GIS-based boarding house locator in meeting user needs. Moreover, the evaluation showed that the platform provided a robust, high-quality solution, and the positive feedback from NVSU students and other users suggested that the system was well-received and had the potential for wider application in similar contexts.

3.4. System performance and accuracy

The platform performed well in terms of system performance. During testing, the platform showed significant efficiency in the delivery of results. The platform allowed for quick loading and timely display of results. Also, response times were low over a large number of requests. The search algorithm applied GIS data to calculate the distance between the user's place and available boarding houses efficiently and without delay.

Moreover, real-time updates on the site would mean that students will be accessing the most current information related to availability and price. The owners of the boarding houses could update the listing dynamically so that the platform reflected accurate and current information. This capability ensured the relevance and reliability of the platform which addressed one of the major concerns in online housing platforms: outdated or incorrect listings. Ristanto *et al.* [32] asserted that mobile online information platforms are more efficient and more successful in informing the community with information. Moreover, Mangca [33] also asserted that web-based information systems provide scalability, cost-effectiveness, increased security, and better chances for cooperation and communication.

3.5. Traditional vs. GIS-based search methods comparative analysis

The comparative analysis between time over cost presented in Table 1 further underlined the advantages of the GIS-based platform in comparison to the traditional search methods for accommodations. Compared to conventional methods, where much time must be invested in the result of actual site visits, the GIS-based platform represents a digital solution that saves time and effort.

- Time savings: the platform saved an average of 181.25 minutes per search, making the accommodation search process more efficient.
- Cost savings: the traditional method cost an average of 55 PHP, while the GIS-based platform cost an average of 20 PHP, and saved 35 PHP on average per search.
- Satisfaction improvements: user ratings for the traditional approach, on average, score an average satisfaction of 2.75, whereas, in the case of the GIS-based platform, the user got an average satisfaction of 4.825 and was highly satisfied.

These outcomes gave evidence that utilizing the GIS-based platform saved a significant amount of time and money spent while improving the quality and experience of the service received by students who found or looked for accommodation in proximity to NVSU Bayombong Campus.

3.6. Implications for student accommodation solutions

The success of this GIS-based platform held significant implications for student accommodation solutions, particularly in regions with underserved or difficult housing markets. This platform represented a replicable model that other universities or educational institutions, especially in rural or underserved areas, might use, where students similarly face challenges in accessing and finding accommodations. With a digital solution integrating geospatial data with user-centric features, the platform could be extended into other regions or customized to accommodate a range of different student needs. Embedding a map may facilitate navigation and inform the population regarding the boarding house location. Also, Sari *et al.* [34] asserted that map shows relevant information like where boarding houses are located, public transportation, and other amenities in the area. Moreover, the platform might serve as a useful resource in the monitoring and regulation of boarding house facilities for the universities and local government. Boarding house owners would be able to update listings and monitor business permits as well, ensuring they adhere to local housing laws while helping to create a more secure and orderly living arrangement for students.

3.7. Limitations and future work

The study had limitations despite the positive results. Currently, the platform only caters to NVSU students and its surrounding areas, and whether it could be applied to other regions or universities has yet to be tested. Further work could be involved in expanding the platform to other educational institutions. Moreover, the reliance of the platform on internet access might limit its use by students in areas with poor connectivity. Optimizing the platform for offline access or mobile integration could help bridge this limitation and increase accessibility.

4. CONCLUSION

The web-based GIS-based boarding house locator developed for students of NVSU addressed the issues and concerns of finding comfortable and affordable student accommodation appropriately. Results from this study confirmed that the platform provided an effective means of streamlined accommodation search by reducing effort and time in locating accessible housing for students. The platform provided spatially-referenced real-time data through an interface that was intuitive and followed the main objective stated above creating a more accessible, efficient, and easy-to-use housing search platform.

The results showed that by using the GIS-based accommodation search platform, students could get their accommodation in just one fraction of the time when compared to the conventional modes. For instance, within some areas, it shortened the search time from 2 hours and 30 minutes to just 1 minute. This time-saving benefit was a testament to the success of the platform in solving the inefficiencies that had been associated with previous practices in housing search, which relied on physical site visits and unverified word-of-mouth recommendations. The platform's real-time updates, accurate distance calculations, and filtering options allow students to make informed decisions quickly, thus fulfilling the expectations.

Additionally, the platform showed good strength in quality attributes, including performance, and reliability. Thus, it indicated its capability as a tool for students. High usability ratings and portability ratings reinforced the reliability and adaptability of the platform. In the future, the success of this platform in NVSU, would serve as a starting point for enhancing its applicability for usage in other universities or areas. The GIS-based platform model will be adaptable to meet accommodation challenges similar to these problems in underdeveloped and rural areas, having great potential as a source of value for educational institutions everywhere. Further expansion of the platform to reach other universities and regions may help refine its features so that it would be applicable in more diverse student housing situations and improve its functionality. In conclusion, the GIS-based boarding house locator had met all the expectations set out. This platform has improved the accommodation search process for NVSU students and would likely to have wider applicability in other universities and regions that face similar housing challenges. The successful outcome of this study combined with prospects for future development and application indicates a strong possibility for this platform to assume an important role in developing more efficient and accessible solutions for student accommodation in the future.

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AUTHOR CONTRIBUTIONS STATEMENT

This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

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C : **C**onceptualization
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E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

CONFLICT OF INTEREST STATEMENT

Authors state no conflict of interest.

DATA AVAILABILITY

Data generated and analyzed during this study are available from the corresponding author upon reasonable request. The data, which contain information that could compromise the privacy of research participants, are not publicly available due to certain restrictions. Requests should be directed to the corresponding author's contact details.

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