

MAPASAKATAN: A WEB-BASED APPLICATION DESIGN PROTOTYPE USING OPENLAYERS 6.0 FOR FINDING BOARDING HOUSES IN THE SURROUNDING VICINITY OF USTP-CAGAYAN DE ORO CAMPUS

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ABSTRACT: Every start of the school year faces new and cyclical challenges to the tertiary students. One of these challenges, especially those students who live far from the school campus, is finding an accessible and appropriate boardinghouse in the vicinity of the campus. In the University of Science and Technology of Southern Philippines – Cagayan de Oro Campus, twenty-eight (28%) percent of the students lived in neighboring provinces. Every semester these students keep on finding temporary boarding houses to stay-on for the whole semester. Determining options based on availability, cost, services and facilities are difficult to achieve without any tools which provide the students the essential information. This developmental research came up with a design prototype of an online mapping of boarding houses for students. It uses OpenLayers 6.0, PHP, JavaScript, MySQL, Bootstrap, HTML, PHPMailer, and CSS to develop the mapping system. To test the functionalities of the prototype, the developers used different user-based scenarios to determine that all functionalities and processes in the system are working well. As a result, all the functional requirements based on the user requirements were met. Renters can search the preferred board and lodging based on filters like location, type of property, and cost. The Landlord-user can manage their board and lodging properties by uploading relevant information and images subject to the approval of the admin user. This prototype is recommended for pilot testing into a more realistic situation to test its actual performance with multiple users, test the database behavior and determine its usability.

Keywords: OpenLayers, online mapping, design prototyping model, innovation, web-based application

1. INTRODUCTION

The University of Science and Technology of Southern Philippines (USTP) is a University System with eight campuses all across the Northern Mindanao Region. Among the eight campuses, two are the major campuses: 1) USTP-Cagayan de Oro (CDO) Campus which is located at the capital city of Misamis Oriental, and 2) USTP-Claveria Campus located in the Municipality of Claveria, province of Misamis Oriental. Other satellite campuses are the USTP-Panaon and USTP-Oroquieta which are located in the province of Misamis Occidental while four other campuses are found in the neighboring municipalities in the province: USTP-Jasaan, USTP-Villanueva, and USTP-Alubijid. USTP-Balubal is another satellite campus inside the City. Among the eight campuses, the USTP-Cagayan de Oro has the highest number of student population. For school year 2022-2023, the officially enrolled college students reached more than 14,000. As for the records from the Admission and Scholarship Office of USTP-CDO, around 25%, more or less 3,500 of the students lived outside the province of Misamis Oriental.

It has been observed for every start of each semester the common struggles of students particularly the freshmen are where to find the appropriate boarding house in the vicinity of the campus. The term boarding house may be referred to as apartment, bed spaces, dormitories, transient, or the boarding house itself. It was observed that students preferred to rent boarding houses which are in proximity of the campus for economic reasons. These students merely rely on 1) friends' referrals, 2) internet and social media, and 3) posters and billboards. Student boarders first option to search for boarding houses is the indorsement of family members of friends who has sufficient knowledge or experience of the boarding house. Through their friends' recommendations, the student boarders can pool good options and alternatives of

boarding houses to which they will choose from. In addition, student boarders also used the information provided by the internet, particularly on the social media. These wide range of information can make the searching more comprehensive and convenient. Furthermore, the student may opt to conduct an ocular search of these boarding houses to physically check the exact location of the boarding house, inspect the completeness of the facilities, and evaluate the safety and security of the area and its surrounding. Although the strategies of searching preferred boarding house mentioned above are useful to the students the method still need to be streamlined and should be straight forward to meet the immediate needs of the student boarders. The features of searching must be focused on the preferences of the student boarders. In order to address the current issue, the design prototype of a web-based application for finding boarding houses in the vicinity of USTP-CDO was initiated.

The main objective of this project is to come up with a web-based application of a boarding house locator that uses mapping system which provides the USTP students relevant information about the boarding houses and in the nearby vicinity of USTP. Furthermore, this prototype will be used as platform for local land lords to advertise and promote their boarding houses to the students. For demonstration purposes, the images displayed in the prototype are all temporary and were downloaded from different sources.

2. Conceptual Framework

The design proto type was named MapaSAKATAN. It utilized the available free development software tools, internet and web technology. The system used a Hypertext Processor (PHP) embedded in the HyperText Markup Language (HTML) code to create a dynamic content since it runs as a web server. The Cascading Style Sheet (CSS) provides enhanced design of the Graphical User Interface (GUI) for a better interface quality. The Bootstrap and

Javascript codes were used to create fully responsive themes, thus making it compatible to any web browsers and devices accessing the MapaSAKATAN server. All information going to and from the system are stored in a MYSQL database. MapaSAKATAN is hosted in a cloud though a third-party commercial hosting provider. Users need the web-browsers and internet connections through their mobile gadgets to access the MapaSAKATAN server. Figure 1 shows the System Architecture of the system.

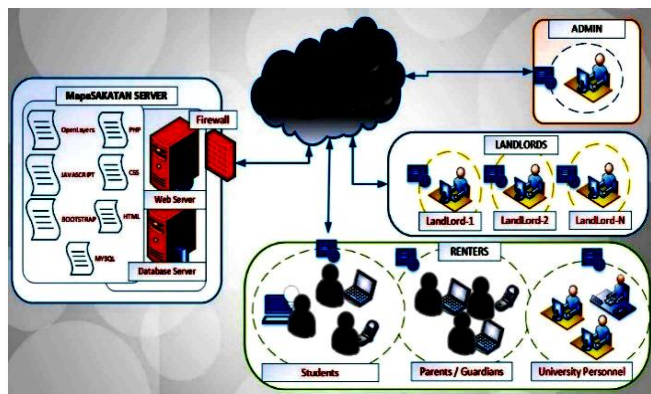


Figure. 1: MapaSAKATAN System Architecture

Furthermore, the system has access rights for different users. Landlord-user is required to register in the system. Once approved by the Admin-user, the Landlord-user need to log-in using their username and password. The Landlord user can view and manage its for-lease boarding houses by uploading its images, detailed information, rates, and importantly the exact location and availability. The postings need to be approved by the Admin users. The Admin user can manage the user accounts in the system like enabling or disabling Landlord user.

The prototype had undergone Alpha Testing using different scenario-based testing in order to examine the basic functionalities of the different processes in the system. The Alpha Testing includes different user-defined scenarios: Renter-user scenarios, Landlord-user scenarios and Admin-user scenarios. The goal was to determine whether the user-interface elements are working according to the requirements of the system and to check the accuracy and consistency of data processing and how it is being displayed in the user screen. Figure 2 shows the context diagram of MapaSAKATAN.

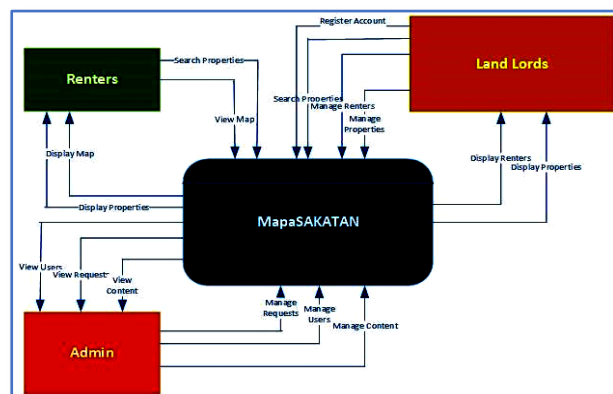


Figure. 2: MapaSAKATAN System Architecture

3. Literature Review

The wide definition of the Geographical Information System (GIS) depends on the perspective or disciplinary origin [1]. It implies an interest in the spatial identity or locality of certain entities on, under or above the surface of the earth [1]. Furthermore, Information implies the need to be informed in order to make decisions. Data or raw facts are interpreted to create information that is useful for decision-making and System implies the need for staff, computer hardware and procedures, which can produce the information required for decision-making that is data collection, processing, and presentation. GIS is a system of hardware, software, and procedures designed to support the capture, management, manipulation, analysis, modeling, and display of spatially referenced data for solving complex planning and management problems [2-5].

As a powerful open source development framework, OpenLayers has characteristics of powerful function. It has attracted the attention of numerous researchers since its emergence [6]. OpenLayers have a free web map application example to discuss the technical status and potential of intelligent map browsing in Web browsers. Using tools such as OpenLayers, it described the digital "planning" process available in the Scottish Ordnance Survey Historic Town Plan, available on the website of the Scottish National Library [7]. A research made which integrated the pipeline data management application based on Web GIS application with Google map data set by using the open source technology and Smart Map and OpenLayers[8]. Based on OpenLayers, a study on public meteorological service system, analysis chart and road map have been superimposed by Open Layers GIS technology to complete the public meteorological service products meeting the need of users [9]. Another study on the development of ship information management system. The system can display a large number of spatial data efficiently and synchronously in browser through OpenLayers, and provide map function services such as attribute query, spatial retrieval and statistical mapping and has the basic functions of map enlargement, narrowing, translation and so on in the application of OpenLayers technology in the remote monitoring and control system of fire protection [10, 11]. In the research of real-time visualization design and realization of tourism resource allocation based on Open Layers and Web Socket [12], it realized the display of tourism resource allocation information on thematic tourism map by using Open Layers technology. Interestingly, one project which utilized JS framework OpenLayers, GIS service software GeoServer and other open source technology to construct hydrologic on-line detection system came up with better construction cost and operation and maintenance cost advantage in providing hydrological information monitoring service compared with commercial software [13].

Information system development follows different models of the System Development Life Cycle (SDLC). One of the popular models is the prototyping model whose approach defines an initial list of user requirements, builds a model of the system and then improves the system in several iterations based on user's feedback[14]. It was argued that there are two different prototyping method which include system and

design prototyping. It was further differentiated that system prototyping produces a full-featured working model of the information system while design prototyping is used to verify user requirements after which the prototype is discarded and implementation continues [15]. It was highly emphasized that prototyping is beneficial since analyst and designers quickly develop a smaller version of the system [14]. There are several uses of a prototype. The prototype model is very useful in developing the graphical user interface (GUI) part of the system. Prototyping model can be used when the technical solutions are unclear to the development team. Major design decisions depend on issues such as the response time of a hardware controller or the efficiency of a sorting algorithm. In such circumstances, a prototype may be the best or the only way to resolve the technical issues. The third reason for developing a prototype is that it is impossible to get it right for the first time and one must plan to throw away the first product in order to develop a good one later as advocated [16].

However, prototyping model has some drawbacks [15]. It is said that the rapid pace of development can create quality problems, which are not discovered until the finished system is operational. The second drawback is that other system requirements such as reliability and maintainability cannot be tested adequately using a prototype; thus, resulting to systems that does not capture all requirements. The third drawback of prototyping is that in a very complex system, the prototype becomes unwieldy and difficult to manage [15].

A similar mobile app project, named Board Me App [17] which was developed using the GPS technology in their Board Me App project. The developers used the Agile-Waterfall methodology. The Board Me App helps the students of the University Belt find the nearby dormitories from the University. The information can be access using the mobile phone that is connected to the internet. Their mobile application has three user categories, the mobile user, the boarding house owner and the admin. The application is consisting of three major modules; the Boarding House Locator Module, the Custom Search Module and the contact Us Module. The mobile application can display the location of the boarding house through the mapping page. A comparable Android-based application) named HAYBOL [18] which uses the Rapid Application Development (RAD) Model. This application has three user access level; the User, the Landlord and the Admin. It uses the GPS technology to determine the location of the apartment being searched and its distance from the location of the user.

4. METHODS

This developmental research used the Prototyping Model [14] of the Systems Development Life Cycle (SDLC). This model is used when the customers do not know the exact project requirements beforehand. Prototyping produces an early, rapidly constructed working version of the proposed information system. The developers of the MapaSAKATAN invited ten students to an informal interview. The interview aimed to gather initial information from the users. These students were all living outside the province of Misamis Oriental and they were all renting a boarding house in three different Barangays adjacent to the University. All

information gathered were listed down and the developers concerted the requirements into a system module matrix. The team developed three separate user modules: 1) Renter-user module, 2) Landlord-user module, and the 3) Admin-user module.

The PHP and HTML programming languages were used to code the front-end of the system. JavaScript and Bootstrap were integrated in the code to create a more dynamic and responsive Graphical User Interface (GUI). Since the prototype uses mail and messaging features, the PHPMailer was used to execute mailing services in the system. The opensource MySQL database languages was used to serve in the back-end in creating tables where the information is to be saved. Open-sourceOpenLayer API software was integrated in the PHP coding to allow the web-browsers display interactive mapping features. After completing the development of the prototype, the team conducted the Alpha Testing to test the functionalities of the system and to determine whether the user requirements were met.

For the context of this project, three boarding house types were considered: 1) boarding house, 2) apartment, and 3) bachelor's pad. MapaSAKATAN uses a mapping and information system in order for the user to locate the exact location of these boarding houses as well as essential information about the boarding house. It has features that uses icons and color-coding schemes to identify the availability of the boarding houses. The prototype has a module for landlords to upload the important information of the for-lease boarding houses. An admin module is also created in order for the system to be managed and controlled purposely. The prototype does not include reservations and payment transactions.

5. RESULTS AND FINDINGS

The prototype of the mapaSAKATAN has been developed successfully. The three user modules were created and tested their respective functionalities. Figure 3 below show the landing page of the system. The button "Browse Now!" are for general users who wish to browse and search for their desired boarding house. There is a Log-In button which is intended for registered Landlord-user.

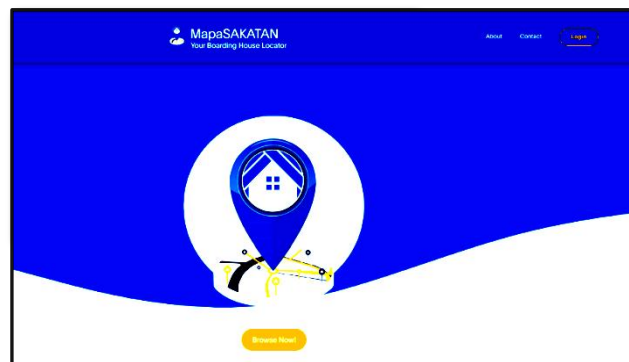


Figure 3. Landing Page of MapaSAKATAN

For Renter-users, when the Browse Now! Button is clicked, MapaSAKATAN will display the map with the exact location of the boarding houses registered in the system. The left panel displays the legend information of the icon and the color-coding scheme applied show which boarding house is

full, partially occupied and available. When an icon is clicked, the boarding house details will be displayed on the right panel of the screen. Figure 4 shows the screen mapping the registered boarding houses in the vicinity of USTP.

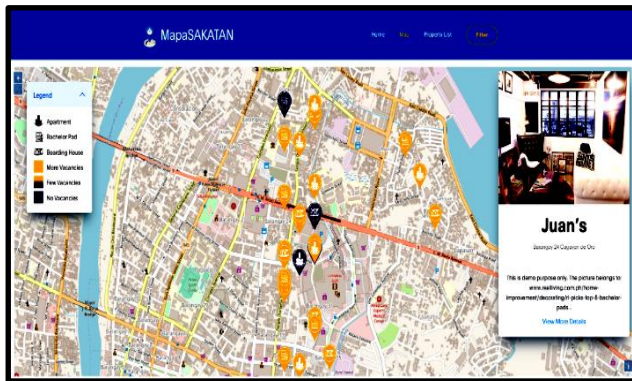


Figure 4. Mapping page of MapaSAKATAN

The Renter-user interface also has the Property List button which displays the filter search control panel and the boarding house display page. When the Filter button is clicked, search filters will be displayed on the left pane of the page. The user can filter their search using type, barangay, preferred tenants and the rate range. Figure 5 below shows the filter panel of the system.

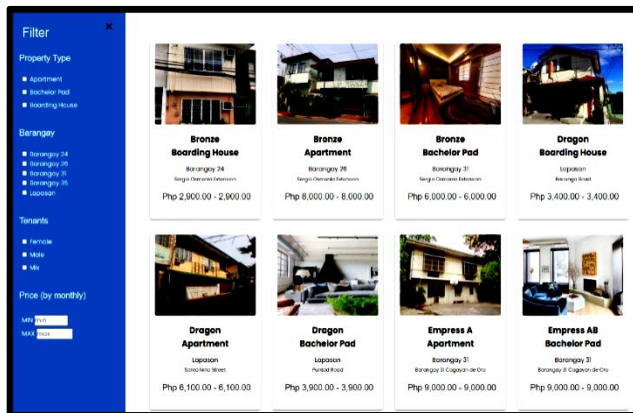


Figure 5. Filter panel of MapaSAKATAN

When a Renter-user click a specific boarding house displayed on the page, the system will prompt the boarding house details: image, name, exact address, preferred tenant, overview and the rate. The prompt also provides additional



Figure 6. Landlord-user Dashboard

Information about the rooms, map location, and the contact information of the Landlord. Figure 6 shows the boarding house information page. On the other hand, MapaSAKATAN has a log-in button intended for the

Landlord-user. Once logged-in, the Landlord-user dashboard displays the boardinghouse that were registered and those that were pending for approval, returned and blocked status. Their dashboard also displays the list of renters, inquiries and messages from the Admin-user. The Landlord-user can view the details of the selected boarding house displayed in the list. Figure 7 shows the interface of the Landlord-user dashboard.

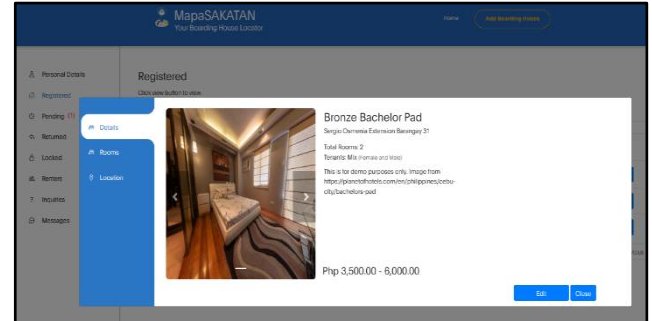


Figure 7. Landlord-user Dashboard – View Details

The Admin-user dashboard displays the list of boarding houses in the system. The boarding houses are categorized into different status: Registered, Pending, and Returned. The dashboard can also display the list of Landlord-user, both Verified and Unverified. It has a search feature to shorten the lists based on the preferred search parameters. To view the details of the boarding house, the Admin-user can click the View button. The Admin-user account can also change the status of a specific boarding house through a Lock button. Figure 8 and Figure 9 show the user interface dashboard of the Admin-user account.

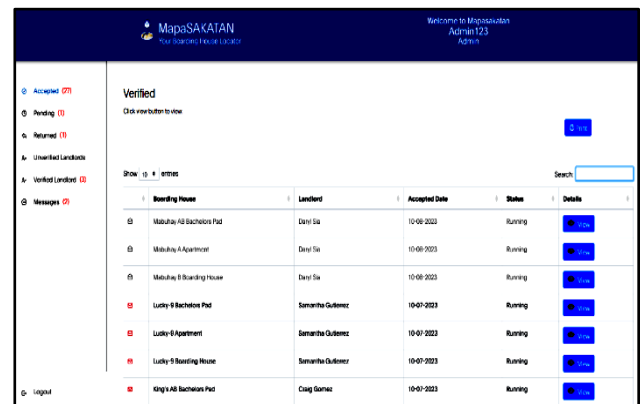


Figure 8. Admin-user Dashboard – List of Registered Boarding House

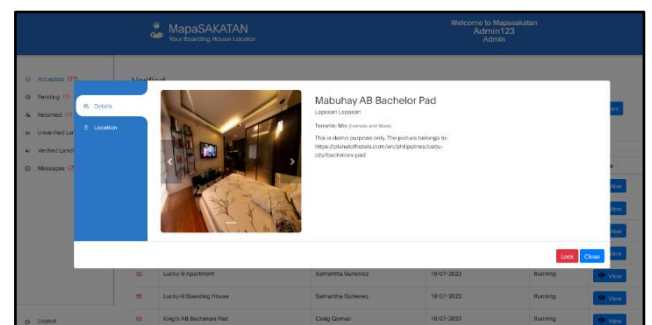


Figure 9. Admin-user Dashboard – View DetailsRegistered Boarding House

During the Alpha Testing the developers ran all the tasks identified in all the user modules. Various scenarios per user account were identified to enumerate all the tasks to checked. Each task has corresponding functionalities tested and evaluated. Overall, the enumerated functionalities correspond to each task in all the identified scenarios were working well.

6. CONCLUSIONS AND RECOMMENDATIONS

The development of the MapaSAKATAN web application prototype is a working system that allows the users, especially the students to search preferred boarding houses in the nearby vicinity of their campus. The application provides them essential information that will aid them in finding suitable shelter while they are studying. The use of Openlayers 6.0 API served the purpose of integrating basic features of mapping system in the application. The use of other mapping API is highly recommended for more sophisticated and complex mapping application. The MapaSAKATAN could further be tested in full scale implementation integrating building codes and housing standards instigated in the local governance of Cagayan de Oro City. Performance evaluation using System Usability Scale (SUS) and other system evaluation instruments is highly recommended to review user experience and aid as basis for further feature enhancements and improve user experience.

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