Android-Based E-Tourist Maps and Navigation for Pangasinan

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Abstract – *The project sought to identify the data requirements needed for the application, to identify the features of the application, to identify the hardware and software requirements of the application, and to test the usability of the application Android-based Pangasinan's Tourist Map. The descriptive type of research aims to identify the data requirements needed for the application and the developmental type of research in developing the system following the phases of the Rapid Application Development Methodology. Results showed that the application is highly acceptable among tourists. Further study should be made to assess the overall performance of the system so as to accommodate room for improvement*

Keywords – *E-tourist. Maps, Navigation, Android*

INTRODUCTION

Tourism is a large growing industry across all countries. A lot of people use to travel to different locations whether local or international. Some people travel in search of beauty, others to satisfy their curiosity, and many people consider traveling to be a good form of rest. As the world is being discovered, many new places are being introduced to the people. These places may be on land and water. It may be in the form of a mountain, waterfall, caves, beaches, islands, and other natural form environments. With this being introduced to the people tourism will then increase in that country. (Tourism-Review, 2011)

In 2008, World Tourism Organization defined tourism as the set of activities of a person traveling to a place outside his or her usual environment for at least one night, but less than a year and traveling is the main purpose other than the exercise of an activity remunerated from within the place visited. Activities like vacation, out of town adventures are some of the purposes. This excludes trips within the person's community of residence and routine commuting trips.

Generally, tourism is divided into the following categories namely domestic tourism, where residents of a country visit destination of their own country. International tourism is sub-divided into inbound tourism where residents of a country visit the destinations of other countries while internal tourism is the combination of domestic and inbound tourism. National tourism is the combination of domestic and outbound tourism. There are also many other types of tourism that fall under a "niche" or specialty travel category. This category of travel has evolved in recent years and describes the various reasons why people travel for recreation, business, and leisure. (Heimo, 2011).

In the past, people had a hard time traveling with the use of primitive tools. A printed map, compass, and road signs are some of the old ways to promote or direct tourists to their desired locations. These tools are not time-efficient and take a lot of time for tourist to find their location, the risk is they might end up lost. Visiting an unfamiliar place may be unsafe for travelers who relied upon these tools in the past. With the increasing number of tourists coming to the country, the problem arises on how to promote the country's great places.

The travel and tourism industry in the United States generated nearly $1.5 trillion in economic output in 2013. In 2014, U.S. travel and tourism output represented 2.6 percent of gross domestic product. According to U.S. Department of Commerce projections, international travel to the United States should grow by 4.3 percent annually through 2020. (SelectUSA, 2015)

Tourism Australia is the Australian Government agency responsible for attracting international visitors to Australia, both for leisure and business events. The organization is active in around 16 key markets and activities including advertising, PR and media programs, trade shows and industry programs, consumer promotions, online communications, and consumer research. On June 21, 2015, Results from the latest International Visitor Survey show that for the year ending December 2014 leisure travel dominated growth in visitors, with holiday arrivals increasing 8% to 2.9 million, and those visiting friends and relatives up 10% to 1.8 million. And on September 2 2015, Results from the latest International Visitor Survey were released by Tourism Research Australia today and show for the year ending June 2015: international visitor numbers increased 7% to a new high of 6.6 million visitors and international visitor spending grew by 10% to a record

$33.4 billion—or $3.2 billion more than the previous year. (Tourism Research Australia, 2015)

In Asia, the Philippines has a natural competitive advantage in tourism, Because of the warmth of its people and its natural wonders that are yet to be full harnessed. (Virola and Amoro, 2003) Tropical countries like the Philippines has many small islands, and have a lot to offer to tourist without the need for huge sums of investments. Many attractions for tourists are in the country without any investment. The breathtaking natural environment, the tropical sea, the beaches, and more inland and mountainous areas. Even the habitations, especially the more traditional settlements, the habits, are also very attractive to tourists. (Philippines and Global Inc., 2005)

The advancement of technologies gave birth to mobile devices which can access the internet for Global Positioning Satellite. This advancement gave way for mobile developers to create an application that will locate the destinations people want to go. The relative increasing resolution of smartphones from high definition to the ultra-high definition and the increasing internet speeds from 3G to LTE (Long Term Evolution) technology have opened an interesting opportunity for geographic information system applications to promote tourism.

This mobile application will have the ability to assist the tourist in their travel and guide them to their destination inside Pangasinan. Features include accessing the Google Map or in some smartphone has two preinstalled Map applications (Google Map and Google Earth). This will then now show or give the location where the user intends to go. Also, this application will have the ability to guide you through the map on how to get to the user's desired location. Giving information and historical facts about the location is also one of the features.

With the emergence of mobile applications, other known as apps, people today are more dependent for information on the go. This is one of the enhancements of mobile phones that allows developers and programmers to offer users just what they seek. One of the latest unique innovations is Google's android, which instantly has taken over the mobile market. It is an open source mobile platform which allows developers from all around the world to develop applications for android supported mobile devices. The Android's open nature has further encourage a lot of developers to use the open-source code as a pillar for their projects which add new capability for advanced user or bring android to

device which were officially release running other operating system(Angle, 2013).

With the increasing number of tourist, programmers can now develop an application that will be at help to tourist. Now this application is a tour and guide for the users, that's why the developers included descriptions about the location, events that happen in that place so that it's not only an app to locate tourist hotspot but also to educate the users and at the same promote the country as well.

In Luzon, one of the most visited province in terms of tourist attractions is Pangasinan. It was among the earliest political and administrative units in the Philippines. Its name is derived from the word "panag asinan", which means "where salt is made", owing to the rich and fine salt beds which were the prior source of livelihood of the province's coastal towns. The province is divided into two sections the eastern and western Pangasinan.

The province is consist of 44 municipalities that is group in 6 districts. District 1 consist of the municipalities of Agno, Alaminos, Anda, Bani, Bolinao, Burgos, Dasol, Infanta, Mabini, and Sual. District 2 has Aguilar, Basista, Bimaley, Bugallon, Labrador, Lingayen, Mangatarem, Urbiztondo. Distric 3 consist of Bayambang, Calasiao, Malasiqui, Mapandan, San Carlos, Sta. Barbara. Dagupan, Mangaldan, Manaoag, San Fabian, San Jacinto belongs to District 4. While District 5 has Alcala, Bautista, Binalonan, Laoac, Pozorrubio, Sison, Sto. Tomas, Urdaneta, Villasis. And lastly Asingan, Balungao, Natividad, San Manuel, San Nicolas, San Quintin, Sta. Maria, Tayug, Rosales, Umingan belongs to District 6.(Province of Pangasinan, 2011).

According to the Distribution of Regional Travellers in the Philippines, the province of Pangasinan has roughly 7,000 foreign travelers and 45,000 domestic travelers. Most of these tourists used a self-navigational map, and compass, while others preferred to be accompanied by a locale that will guide them on their trip. (Department of Tourism, 2014)

People know that Pangasinan holds a number of places to tourists/traveler to visit. Some of these places are Alaminos Wharf, Manaoag Church, Bolinao, Capitol, Umbrella Rock Anda and other beautiful places. Now that tourism in the Philippines is still on the rise, it is a good idea to promote the great hidden treasures of the province of Pangasinan.

In the light of this issue, the developer made every effort to develop an android based tourist spot

directory to help users travel with ease, without guessing to know where they are. The developer will also be handling its user-friendly interface and fully operational capabilities. And because of the wide variety of choices, the Android phone comes in different price ranges from a few thousand pesos to a high-end mobile phone with an expensive amount. Since almost all tourist has their own Android phones, the developer made it user-friendly and easy to access using their mobile devices.

OBJECTIVES OF THE STUDY

The main objective of the project was to design and develop an Android-based Pangasinan's Tourism Map and Navigation for android platform which helped in pointing out the direction of people in visiting tourist spot.

Specifically, it sought to meet the following objectives:

1. to identify the requirements that is essential in the development of the application in terms of.
   a. Data
   b. Hardware
   c. Software
   d. Network;
2. to determine the Features of the application; and,
3. to test the usability of the application.

MATERIALS AND METHODS

Research Design

Descriptive research is a study designed to depict the participants in an accurate way. To put it more simply, descriptive research is all about describing people who take part in the study. Development research is a study focused on the progressive changes that occur as an organism develops. There isn't any way to reverse the changes that happen when you grow up. You can't take an older person and hit the reset button to revert them back to childhood to see how raising them in a different time will change who they are. It'd be nice, but unfortunately, we are stuck experiencing time in one direction (Kowalczyk, 2003).

Descriptive-developmental research was utilized in this project by the developer. Descriptive research as the type of research used to obtain information concerning the current status of a certain event. A number of survey methods were utilized in order to acquire all pertinent information. The acquired data shall be considered statistically to analyze and evaluate the current condition of the application. Therefore, the descriptive type of research is employed because the study involves gathering, organizing, tabulating, interpreting, and presenting data that were obtained from the respondents to identify the data requirements of the application (Key, n.d.).

The descriptive-developmental type of research conducted by the developer has been matched to a felicitous approach for android application development with software methodology kenned as rapid application development. These two approaches are deemed appropriate and absolutely suitable for the development of the project on hand as both of these research design complement one another.

Descriptive research describes, evaluates and analyzes the data requirements of the system and in addition it provides information on the desired functions and features of the stakeholders, while the development type of research is administered in order to develop an application in accordance with the requested requirements both functional and non-functional.

The developmental type of research is systematic study of designing, developing and evaluating instructional programs, process, and products that must meet the criteria of internal consistency and effectiveness. It involves the engenderment of erudition with the ultimate aim of ameliorating the process of instructural design, development, and evaluation. Development research is predicated on either situation-concrete quandary solving or generalize inquiry procedures (Seel and Richie, n.d.).

RESULTS AND DISCUSSION

Requirements of the Application

Data Requirements.

Data requirements provide a detailed description of the data model that the application must use to fulfill of the Android-based Pangasinan E-Tourist Map. It is as detailed as possible concerning the definition of inputs, procedures, and outputs. The requirements needed in developing the software used by the developer were based on their experiences or derived from different books. Data requirements include the software needed in development, the map, and the directory used for the basis of information.

The map contains street names, and addresses. This shall serve as the reference guide for the developer to point out the route of the Tourist destinations further this feature also determines the time required for travel and the kilometers as well.

Municipalities and Tourist destination list services present the names of available outlets within the Pangasinan. The List provides details about the municipalities, history, livelihood, products, populations, fiesta, and tourist destination for each municipality, this shall then serve as the basis for the development of the application.

Hardware requirements.

The following hardware Specification are the needed platforms for the application to run smoothly.

Table 4.1 shows the minimum hardware requirements in deploying the Application.

Component	Specification
Screen Resolution	QVGA TFT LCD or larger, 16-bit color or better
Memory	Minimum: 320 x 480 Pixel or Higher
Storage Memory	128 MB RAM, 256 MB Flash External or higher
Processor	Internal Storage: 2Gb or higher
GPS/Wifi/Data connection	Mini or Micro SD: 1Gb or higher
	800Mhz or Higher with single Processor or Higher
	Wireless LAN 802.11b/g/n/3G Signal

Table 4.1: Minimum Hardware Requirements

To provide a better view of information that contains graphical data such as images on the screen, the display quality is usually considered. Different screen displays may project different presentations of images, to prevent instances of broken images, a minimum requirement is set. The settings is better known as dots per inch, the basic building block of images in a given screen resolution. The minimum resolution for the application for better viewing is at least 320 x 480 Pixel or higher.

In order for the application to run smoothly without lagging, a minimum amount of sufficient memory space is required to execute the program. A memory is computer hardware that is embedded in any electronic devices such as computer and portable devices that serves as a vessel for the data and the program is executed. The minimum requirement for the application to run is at least 256 of RAM.

Storage Memory is a piece of the hardware component of any electronic device that holds the data and the program per se. the data includes the images needed for the application such as the tourist destination images, data information of tourist destinations and municipalities. The minimum requirement for the application is at least 1 gigabyte of memory storage.

The processor is a piece of hardware that executes the application, in order for the application to work well, a minimum speed of 1.6 GHZ is required. The application requires fast processing speed because of real-time data requirements needed such as the calculation of time and distance.

In order to determine the exact routing details of the tourist destinations itself, a global positioning satellite feature is required. This will guide the user in finding its way going to the destination.

Software Requirements.

The following software requirements are the needed platform for the application to run smoothly.

Table 4.2 shows the minimum software requirements in deploying the Application.

Component	Specification
Android OS Version	Minimum OS version is Android 3.0(Honeycomb) or Higher
Google play Services	Google Play Services 3.2.66 or higher

Table 4.2: Minimum Software Requirements

Android operating system is a mobile operating system. In order for the application to run, an android based platform is required for the execution of the entirely of the system. Mobile operating system manages cellular and wireless network connectivity, as well as phone access. The developer requires to use an Android 3.0(Honeycomb) or higher version of the android operating system as a minimum requirement in order to run the application.

Google Play Service is a proprietary software development kit (SDK) and application programming interface (API) set for Android devices. It provides easy access to Google services and is tightly integrated with the Android OS. Google play store is required in order for the application to be downloaded by the users and even the future users.

Network Requirements.

Network connectivity is essential whenever users need access rights for acquiring information before or during the process being involved in an application. Before using the navigation feature of the application, users are encouraged to use network connections to be able to access the data being used on the portable android device.

The application will run under normal circumstances even without the connection to the internet, however, the global positioning satellite feature requires data connection in order to calculate the exact time and distance as well the routing navigation of the user.

Features of the Developed Application

The Institute of Electrical and Electronics Engineers defines the term feature in IEEE 829 as distinguishing characteristics of a software item such as performance, probability, or functionality. An application is said to be feature-rich when it has many options and functional capabilities available to the user.

Based on an interview and survey of the stakeholders, the following feature for the application has been derived. This section provides the summary of the expected features that the application must possess in order to perform its functionalities.
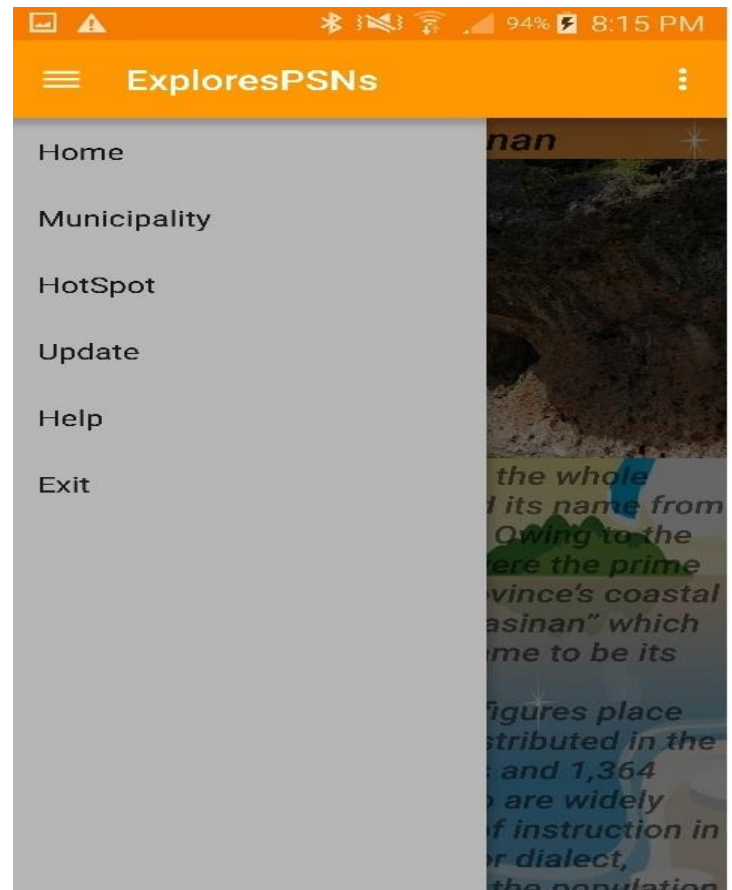

Plate 4.1: Home Screen of the Application

Home screen. The most important feature of an application is the home screen. This shall serve as the initial screen upon opening or startup of the application. The home screen holds the context of the entirety of the application.

The home screen holds different images of tourist destinations being featured. It has two main menus which is the Municipalities and HotSpot. The municipalities when clicked will show to the user the different lists of municipalities in Pangasinan. The HotSpot on the other hand shows a complete list of tourist destinations in Pangasinan. The home screen provides a navigational drawer that contains the following: Home, Municipalities, HotSpot, About, Help, and Exit.

The about menu of the application is one of the most important elements of an application. This screen contains some important information about the application and the developer himself, including copyright information to protect the application from piracy. The about menu in this context contains pertinent information about the details of the copyrights.

Every application must contain a help feature. The developer should give regard to the queries of every user who uses the application. The application must provide enough instruction and guidelines for a user to be familiar with the application. The help screen in this regard provides information on how the application shall be used.

Lastly, the exit menu for the execution of the application, the exit menu will provide a means for the user to exit the application when it is no longer used.

Plate 4.2: Municipalities List Screen of the Application

Municipalities list screen. The municipalities' list screen holds the full list of the municipalities of Pangasinan. The list was arranged alphabetically for easy navigation of the municipalities. Upon clicking the list the user will be redirected to another screen where details about municipal information. Further, upon clicking the list, the application provides an immediate detail about the municipality. This screen contains a navigational menu that helps the user to navigate all throughout the application.
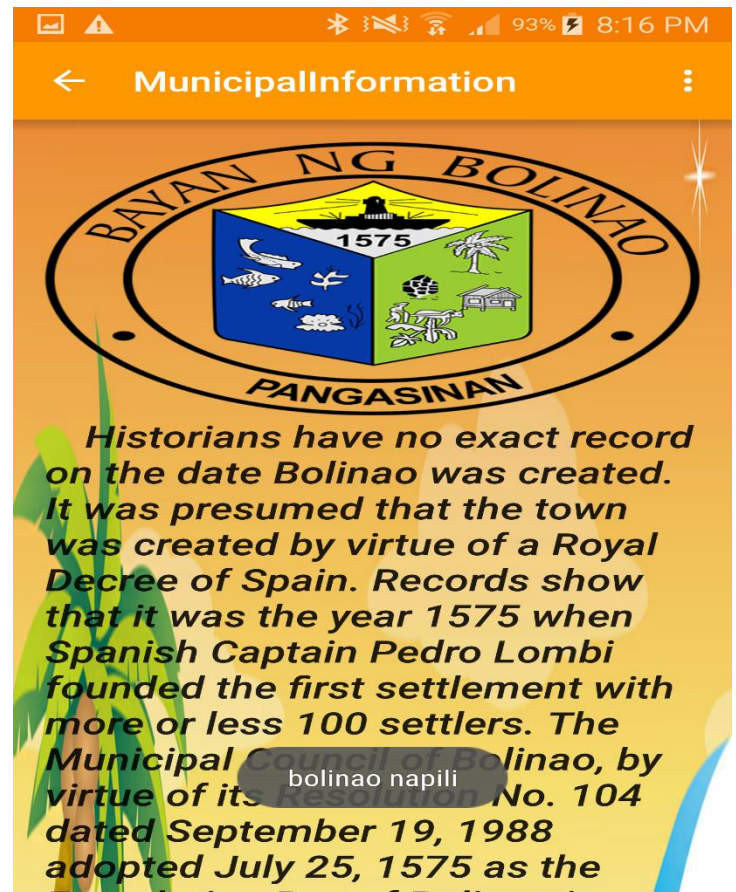

Plate 4.3: Municipal Information Screen of the Application

Municipal information screen. The municipal information screen of the application contains the official logo of the municipality and history with information such as population, size, fiesta, and tourist destination. This screen also includes a button that upon clicking forwards the user to the HotSpot screen where it shows the tourist destination available in that municipality.

Plate 4.4: Tourist Attraction Screen of the Application

Plate 4.5: Attraction Detail Screen of the Application

Tourist attraction screen. The tourist attraction screen provides a flexible display of the destination list. The list will depend on the previous screen. A sorted list will be displayed if the user is from the municipal information screen while a full list will be provided if the user is from the home screen and click the HotSpot on the navigation bar. The screen provides a menu of all, water, and land. This menu provides a different kind of sorting feature. The list will be sorted according to a water-based destination or land-based destination. Upon clicking the list the user will be forwarded to the hotspot detail screen which provides information and lives map on the screen.
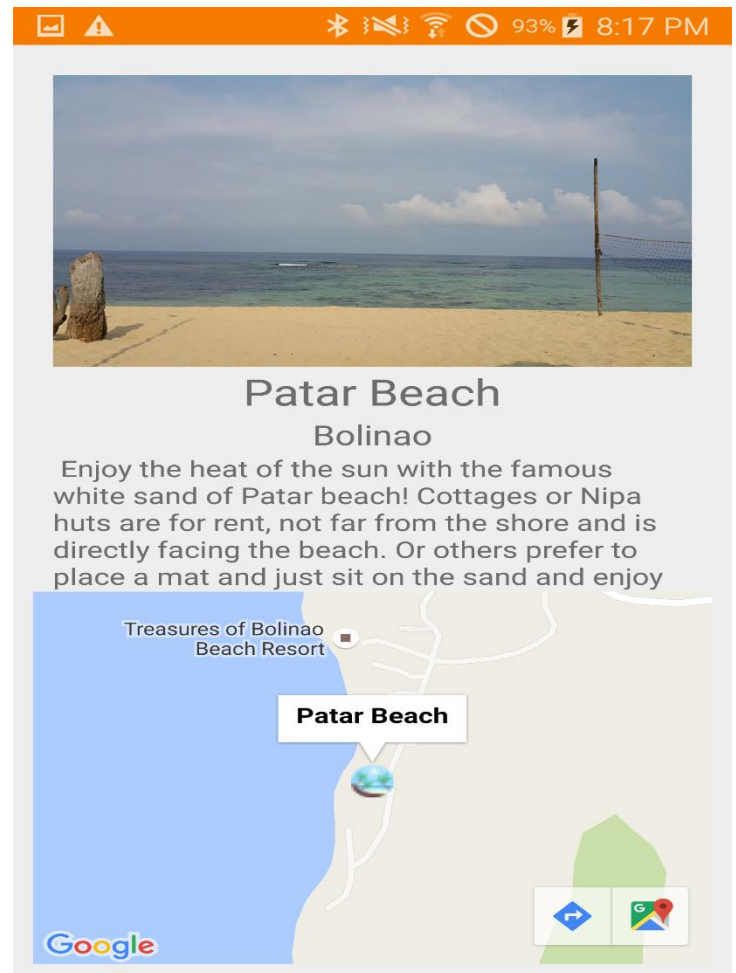
Attraction detail screen. The attraction detail screen provides the main feature of this application. Within this screen contains an image and description of that destination. And it provides the user with a live map that contains the exact location of the destination.

In the map, the user can zoom in and zoom out, and navigate to real-time, this also provides a marker that determines the location. Furthermore, the map has two buttons which is the route button and the more details button. Upon clicking the buttons, the application gives the user access to Google Maps and its features, clicking the route button will provide the user a routing detail, which gives the user, an estimated time, an emphasized line from your location to the tourist destination. Clicking the more detail button gives the user a full-size screen map concentrating on the destination.
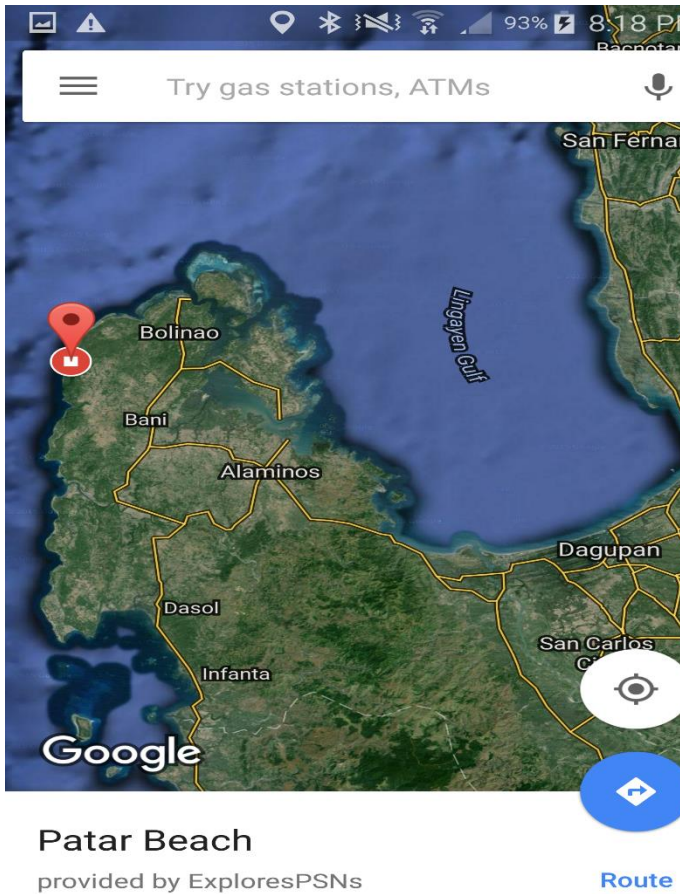
Plate 4.6: Immerse to Map Screen of the Application

Immerse to map screen. Immerse to map screen give the user the full functionality of the google map. These screens give a full-sized map with the destination being marked. It also provides a search bar for random searching, and two buttons, GPS button and the route button which also appeared in the map of the hotspot detail screen. Clicking the GPS button will prompt the user to turn on the GPS. On the other hand, the route button will route the location of the user and the destination, providing the estimated time, and emphasized line to follow.
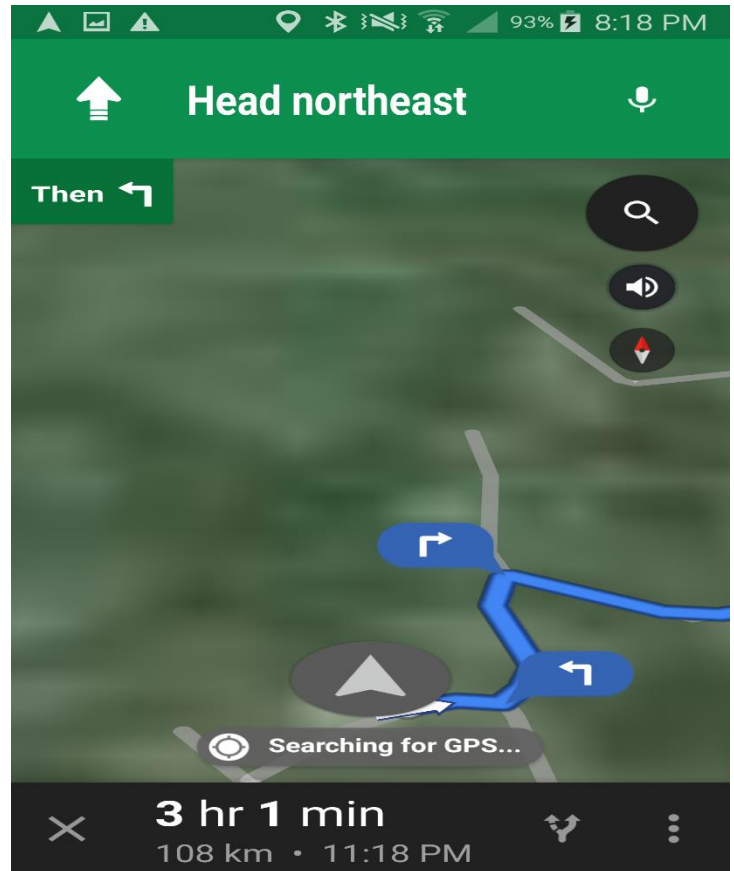

Plate 4.7: Navigation Screen of the Application

Navigation screen. The navigation screen gives the user a live routing system that will guide the user from his location to the destination. The screen provides direction, current distance, and time, it also has a menu for the user to choose what kind of map do the user wants, namely traffic, and satellite. This screen also gives an audio guiding system, which tells the user every turn, and distance of the destination.

Usability of the Application.

Usability is the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use. Usability is being referred to evaluate a product by testing it on users. This can be seen as an irreplaceable usability practice since it gives direct input on how real users use the application. It focuses on measuring a human–made product's capacity to meet its intended purpose.

To test the usability of the developed Android-based Pangasinan E-Tourist Map, the developer

conducted a survey to the local and domestic tourist who were the expected clients or users of the developed application.

Table 4.3.
Application Evaluation According to Usability

Usability	MEAN	DESC
1. I think I would like to use this application frequently.	4.56	SA
	4.44	A
2. I found the application unnecessary complex.	4.69	SA
	4.28	A
3. I thought the application was easy to use.	4.72	SA
4. I thought there was consistency in this application.	4.69	SA
	4.56	**SA**
5. I would imagine that most people would learn to use this application very quickly.		
6. I felt very confident using the application.		
Weighted Mean		

LEGEND: SA: Strongly Agree, A: Agree, U: Undecided, D: Disagree, SD: Strongly Disagree

Table 4.3 shows the respondents' assessment in terms of the application's usability. In terms of frequent usage, the respondents strongly agree with an average score of 4.56. In terms of complexity, the respondents provided an average score of 4.44 in which the respondents agree with the application concept. In terms of ease of use, the respondents provided an average of 4.69, in which the stakeholders strongly agree that the application is easy to use. In terms of consistency, the respondents agree that the application is consistent with a score of 4.28. In terms of learnability, the respondents provided a score of 4.69 which respondents strongly agree that the application is easy to learn, as shown by the 4.56 Weighted Average Mean, the respondents strongly agree that the application is usable.

Table 4.4
Application Evaluation According to Design

Design	MEAN	DESC
1. The application is attractive.	4.08	A
2. The overall application is attractive.	4.03	A
	4.32	A
3. The application has a good balance of graphics versus text.	4.09	A
4. The color used throughout the application are attractive.	3.81	A
5. The typography (lettering, headings, and titles) is attractive.	**4.07**	**A**
Weighted Mean		

LEGEND: SA: Strongly Agree, A: Agree, U: Undecided, D: Disagree, SD: Strongly Disagree

Table 4.4 shows the respondents' evaluation in terms of the application's design. As shows a 4.07 Weighted Average Mean, the respondents' agree that the design used by the developer is pleasing to them and its suits design they are looking for such application.

Table 4.5
Application Evaluation According to Navigation

Navigation	MEAN	DESC
1. It is easy to find my way around the application.	4.18	A
	4.47	SA
2. I can get to information quickly.	4.31	A
3. It is fun to explore the application.	4.47	SA
	3.91	A
4. It is easy to remember where to find things.	**4.27**	**A**
5. Information is layered effectively on different screens.		
Weighted Mean		

LEGEND: SA: Strongly Agree, A: Agree, U: Undecided, D: Disagree, SD: Strongly Disagree

Table 4.5 shows the respondent evaluation in terms of the application's navigation. In terms of accessibility, the respondents provided a score of 4.47, to which the respondents strongly agrees that the application is accessible. In terms of remembering, the respondents provided a score of 4.47 which is describe as strongly agree, this suggest that the respondents somehow strongly agrees with the newly introduced concept. In summary, the table shows a 4.27 Weighted Average Mean, the respondents agree that the navigation capability of the application is sufficient and it leads

them to the functionalities they are looking for in an easy way as expected.

Table 4.6
Application Evaluation According to Information

Information	MEAN	DESC
1. The application is attention-getting.	4.22	A
2. Information is easy to read.	4.31	A
3. Information is written in a style that suits me.	3.88	A
4. Screens have the right amount of information.	4.33	A
5. The application effectively communicates the municipality's identity.	3.99	A
6. The application is designed with me in mind.	3.84	A
7. The application's content interest me.	4.28	A
8. The application's content would keep me coming back.	3.99	A
Weighted Mean	**4.11**	**A**

LEGEND: SA: Strongly Agree, A: Agree, U: Undecided, D: Disagree, SD: Strongly Disagree

Table 4.6 shows the respondent evaluation in terms of the application's information. As shown by table 4.11 Weighted Average Mean, the respondents agree that the information catered by the application is reliable and it provides the information that the respondents needs in their daily transactions.

Table 4.7
Application Evaluation According to User-friendliness

Information	MEAN	DESC
1. The application is exciting.	4.40	A
2. The application is well-suited to first-time visitors.	4.44	A
3. The application is well-suited to repeat visitors.	4.42	A
4. The application has a clear purpose.	4.20	A
	4.12	A
	4.49	SA
	4.35	**A**

5. I always felt I knew what it was possible to do next.
6. It is clear how screen elements (e.g., pop-ups, scrolling lists, menu options, etc.) works.
Weighted Mean

LEGEND: SA: Strongly Agree, A: Agree, U: Undecided, D: Disagree, SD: Strongly Disagree

Table 4.7 shows the respondent evaluation in terms of the application's user-friendliness. As shown by table 4.35 Weighted Average Mean, the respondents agree that the application is user-friendly and it provides the information that the respondents need in their daily transactions.

Table 4.7
Application Evaluation According to User-friendliness

Information	MEAN	DESC
1. Usability.	4.56	SA
2. Design.	4.07	A
3. Navigation.	4.27	A
4. Information.	4.11	A
5. User-friendliness.	4.35	A
Weighted Mean	**4.27**	**A**

LEGEND: SA: Strongly Agree, A: Agree, U: Undecided, D: Disagree, SD: Strongly Disagree

Table 4.8 reveals the respondents' evaluation of the overall usability of the application. In terms of usability, the respondents provided a score of 4.56 which is describe as strongly agree, in terms of design, the respondents provided a score of 4.07 in which the respondents agree that the design used by the developer is pleasing to them, In terms of Navigation, the respondents provided a score of 4.27 which the user agree that the navigation capability of the application is sufficient, In terms of Information, the respondents provided a score of 4.11 which the respondents agree that the information catered by the application is sufficient and reliable, In terms of User-friendliness, the respondents provided a score of 4.35 which is describe as agree. In general the respondents agree with the newly

introduced concept justified by a weighted average mean of 4.27.

IV. CONCLUSION AND RECOMMENDATIONS

Based on the presented findings on the existing means of finding a direction to the tourist destination, the following conclusion were drawn: the data requirements servers as the basis for the development of the application. The data are as follows, google maps and the Pangasinan municipality directory and its pertinent information such as history, population, fiesta, and tourist destination. The features of the application include an assistive global positioning satellite to determine the direction of the mall. Features also include the measure of the distance in terms of kilometers and the time required to travel the distance in terms of hours and minutes with the assumption of the moderate traffic state of the passages. Further, the application features updated images and pertinent details about the municipalities within Pangasinan. The hardware and software requirements for the application includes any devices that run under android platforms either tablet or smartphones. The application is also proven to be usable based on the survey conducted.

It is recommended that before the actual implementation of the developed application: The developer should first conduct an initial beta test to ensure that the application prior to uploading to the google play site is exactly working the way it should be. The developer of the application should also constantly update the images and pertinent details of the municipalities and tourist destinations within. The developer expects that the province of Pangasinan will have more tourist attractions and destinations.

The developer expects in the near future that the said province will have wider network coverage for maximizing the features and functions of the application

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