

Short Paper*

V-Locate: Development of Web-Based Vulcanizing Shop Locator for 2nd District of Oriental Mindoro

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Abstract

Purpose –When traveling, getting a punctured tire is a common and inevitable problem that makes a vulcanizing shop business in demand in the province. Vulcanizing shop repairs flat tires and sells a typical car and motorcycle needs. However, this small business was not tagged in the known navigation application. Thus, the proponents conceptualized a Web-based application locating the nearest vulcanizing shops and motorcycle spare parts stores. The V-locate will not just provide the nearest shops and stores but also the information like the offered products and services. The scope of the map on the said application is only limited to the areas within the 2nd District of Oriental Mindoro.

Method –The methodology used in development is Rapid Application Development (RAD), suitable for creating active phase software applications. To get the exact



coordinates of every vulcanizing shop and spare parts store, the proponents used Geographical Positioning System (GPS) application. Several scripting languages, such as PHP and JavaScript, and their framework and library, are used to develop the app.

Results – The system was evaluated by 60 respondents consisting of faculty, drivers, and Rider's Club members conforming to ISO 25010 software quality standards. The evaluation result got 4.4 for functional suitability, 4.4 for usability, 4.5 for security, and 4.3 for Performance Efficiency, which shows that the system is efficient and feasible for implementation.

Conclusion –The vulcanizing shop in a province like Oriental Mindoro is of great help to travelers when they meet unexpected emergencies like having a flat tire. With that said, the development of the V-Locate application is essential for travelers in case they encounter such a mishap.

Recommendations – For further improvement of the system, it is recommended to conduct beta testing and another evaluation using the remaining criteria of ISO 25010. Also, it is crucial to widen the scope of the map and make it offline.

Research Implications –Once the system is fully implemented, it will ease the burden of travelers in Oriental Mindoro to find repair shops in case of an emergency. Moreover, it also promotes and recognizes the existence of vulcanizing shops as a local business in the province.

Keywords – Vulcanizing Shop, Oriental Mindoro, Locator Map, ISO 25010

INTRODUCTION

A vulcanizing shop is a classic Filipino business typical in the provinces in the Philippines (Panganiban, 2017). Unlike in highly urbanized areas with many repair centers for cars and motorcycles, a province like Oriental Mindoro has a local motorcycle/car repair shop commonly known as a vulcanizing shop. The standard service offered by vulcanizing shops is punctured tire repair for any land vehicles like cars, motorcycles, and bikes. Some vulcanizing shops also offer small engine repair, automotive works, and selling common spare parts.

People nowadays really love to travel, and when traveling, roadside emergencies are inevitable. One of the common problems encountered when traveling by land is getting a flat tire. Aside from mechanical failure, 27 percent of roadside emergencies are tire-related (ActiveTools, n.d.). These statistics showed how important vulcanizing shops are. Imagine the burden of any driver if there is no available car repair center nearest to the place of the mishap. The driver might spend too much time finding repair shops, pushing

their car or motorcycle, and asking other people for the nearest vulcanizing shop in their location.

Modern traveling is easy with the use of mobile phones. Almost 65.3 percent of the total population of the Philippines in 2015 have mobile phones and is expected to accelerate to 70 percent in the year 2020 (Statista, 2016). Most travelers use mobile navigation applications to reach their destinations. However, not all information is available on the leading navigation app, specifically those local and small businesses in the countryside (Pan, Crotts, & Muller, 2007). Despite the importance of vulcanizing shops, they are not tagged in known navigation apps like other small businesses.

The mentioned situation encourages the proponents to develop a web application that can help locate the nearest vulcanizing shops. However, since most of the vulcanizing shops are not selling common spare parts, the proponents also included stores for car and motorcycle spare parts. The main goal is to ease the driver's burden by locating the shops in an unfamiliar place. This development also recognizes the significant role of vulcanizing shops in the community and promotes their services. The system includes vulcanizing shops and car/ motorcycle spare part stores along the nautical highway of the 2nd District of Oriental Mindoro. The system is web-based; thus, operating system compatibility is not an issue. The user must have an updated browser and internet connection to achieve a more satisfying user experience. The web app was named V-Locate, wherein the letter 'V' stands for Vulcanizing shop. The proponents used LEAFLET, a JavaScript Library for mapping, and CodeIgniter, a PHP framework for an interactive web application.

LITERATURE REVIEW

Related Systems

Many similar systems existed and were published in different journals. Of those related systems, the proponents reviewed only ten to expedite the review and focus on extracting the necessary information from each related system. Table 1 shows the salient information about the related system being reviewed. These existing systems served as references that helped identify the developed system's relevant features and functionalities.

The mentioned related systems share the same purpose, and that is to locate some relevant places quickly. Such systems are essential, especially in times of emergencies. People would often look for essential places like banks for the ATM, restaurants, apartments, or even parking spaces. On the other hand, the V-locate app is a web-based application that could locate the nearest Vulcanizing shops and car spare part stores. This kind of web application is new to Oriental Mindoro. Although there is an existing navigation application available, local establishments like Vulcanizing shops and car spare part stores were not visible.

Table 1. Summary of Related Systems

Existing System	Platform	Purpose	Dev. Method	Evaluation Metrics
HAYBOL (Consignado, Velasco, Sanvictores, Jain, & Balahadia, 2017)	Android	Apartment Finder	RAD	Functionality, Usability, Content, Reliability, and Performance
NYAM (Isabela et al., 2018)	Android	Local Restaurant Finder	Not Define	Ease of Use, Content, and Usability
CADBLOS (Ele, Umoh, Ele, & Ofem, 2021)	Android	Bus Locator System	SSADM and Object-Oriented	N/A
Location Based ATM Locator (Das, Purohit, Alam, & Chowdhury, 2017)	Android	ATM Locator	Not Define	Accuracy
College Bus Tracking Android Application using GPS (Kumar, Aishwarya, & Mounika, 2016)	Android	Bus Tracking	Not Define	N/A
MusicHub (Gomez et al., 2020)	Web/Android	Rehearsal Studio Locator and Reservation System	Not Define	N/A
Campus Building Locator (Mustaffa, Iruthayam, Bukhari, & Omar, 2020)	Web	Campus Building Locator	Customized Method	User Friendliness and Functionality
Moommae (Chaovalit & Pongnumkul, 2017)	iOS/Android	Locator for breastfeeding rooms and activities	Not Define	N/A
E-Vision (Ramos, 2018)	Android	Campus Locator Map	RAD	Functionality, Reliability, Usability, Efficiency, Maintainability, and Portability
Little Locator (Lewis, Abbas, Reisenfeld, & Maric, 2018)	Android	Parking Lot Locator	Agile	Features, Functionality, Reliability, Usability, Stability, and Performance

Developing a navigation app for a particular purpose is of great help to solve a local problem like locating a local vehicle repair shop. It is made easy using existing Application Programming Interfaces (APIs) and Libraries for virtual mapping. Many of the cited related systems used Google Map API and ran in an Android operating system. Two of those mentioned related systems implemented the Rapid Application Development (RAD) model. RAD is a software development model designed for a concise development cycle (Fatimah, Supriatna & Kurniawati, 2018). This is very suitable for the development of small and urgent projects like V-locate.

Most of the cited related systems adapted some criteria from the ISO 9126 software quality model in the evaluation. In 2011, ISO 9126 was replaced by ISO 25010, which comprised eight quality metrics: functional suitability, Reliability, Performance Efficiency, Usability, Security, Compatibility, Maintainability, and Portability (França & Soares, 2015). Any of these metrics could be used in the quality assurance phase of every software development.

METHODOLOGY

Data Gathering

The proponents surveyed all Vulcanizing shops, motorcycle/ spare parts stores located beside the nautical highway of the 2nd District of Oriental Mindoro. Other vulcanizing shops situated in some streets of at least 50 meters near the highway are also included. Figure 1 shows the total number of shops and stores surveyed by the proponents in every municipality. The purpose of the survey is to acquire necessary information, which is used as content of the system. Using Google Map, the proponents get the exact coordinates of all target shops and stores.

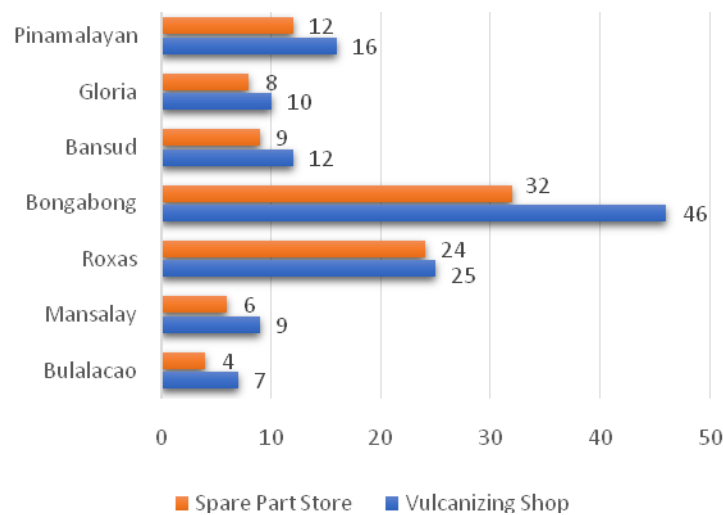


Figure 1. Total Number of Vulcanizing and Spare Parts Store per Municipality

Development Method

The V-Locate application is just a small project compared to other applications for commercial use; hence, the proponents followed the RAD phases, as shown in Figure 2, to successfully develop the web app. This development method is suitable for creating fast phase software application like V-Locate. Also, RAD enhanced flexibility and adaptability as developers can adjust quickly during the development process. Also, it has better risk management as the proponent can discuss and address code vulnerability while keeping the development process (Anand & Dinakaran, 2016).

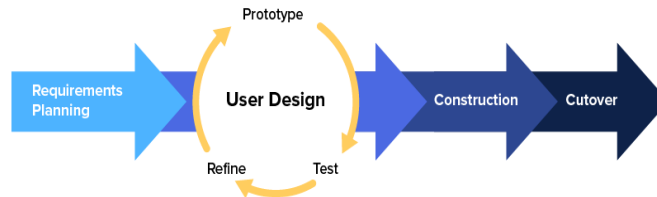


Figure 2. Rapid Application Development (RAD) Phase (Murad, Hussain, Samad, Tah, & Ali, 2018)

The following were the activities done by the proponents in each phase. In *requirement analysis*, the proponents defined all functional and non-functional requirements, user requirements, and; hardware and software requirements. The proponents also identified all necessary technologies needed in the development, like a programming language, API, database, and the like. After identifying requirements, the next phase is user design, composed of three parts: prototype, test, and refine, which is sequential. In the prototype, the proponents designed and developed a simple model that represents the system. The developed model undergone module testing, then fixed some identified bugs and added additional functionalities until it came up with a more efficient and functional model. After the successful prototype development, the proponents add all the expected functions of the system, considering all specified requirements in the *construction phase*. The last phase is the *cutover*, referring to the implementation or deployment of the system. In this phase, the fully developed V-locate application was deployed on the web.

System Evaluation

After the system was fully developed, it underwent system evaluation to determine its efficiency. The proponents chose 60 respondents composed of 10 BSIT Faculty members for the technicalities, 20 random drivers, and 30 Rider's Club members for the user's feedback. The proponent only used one self-made evaluation instrument for all types of respondents shown in Table 2. The instrument was based on the four criteria of ISO 205010, such as functional suitability, performance efficiency, security, and usability.

Table 2. Software Evaluation Instrument

Criteria	No.	Indicator
1. Functional Suitability	1.	The system provides accurate coordinates of Vulcanizing Shop.
	2.	The system provides precise information about the Vulcanizing Shops
	3.	The system runs according to its expected function.
2. Performance Efficiency	4.	The interface is user-friendly.
	5.	The system is fast and responsive.
	6.	The system provides enough information needed to locate better Vulcanizing and Motor spare parts Store.
3. Security	7.	The system does not compromise user's personal information.
	8.	The system secures the stored data safely.
	9.	The system is accessible to authorized users only.
4. Usability	10.	The system works correctly based on user requirements.
	11.	The V-Locate provides the necessary information to locate the nearest vulcanizing shop quickly.
	12.	The V-Locate provides a variety of features related to roadside emergencies.

Table 3. Five-point Likert Rating Scale

Scale	Range- Value	Verbal Interpretation
5	4.21-5.00	Strongly Agree
4	3.41-4.20	Agree
3	2.61-3.40	Neutral/ Uncertain
2	1.81-2.60	Disagree
1	1.00-1.80	Strongly Disagree

The proponent utilized a five-point Likert rating scale to measure the respondents' view towards every indicator, as shown in Table 3. The first criterion was *functional suitability* which has three attributes. These attributes are functional completeness, correctness, and appropriateness. From these attributes, three self-made indicators were formulated for functional suitability. According to Rodríguez, Oviedo, and Piattini (2016), functional suitability is essential to check whether the software product meets all the needs in a specific condition. On the other hand, *performance efficiency* is another ISO 25010 metric whose goal is to evaluate system software performance (Kaur, Grover, & Dixit, 2019). It also has three sub-characteristics composed of time behavior, resource utilization, and capacity. The self-made indicators used in the evaluation of V-locate under the performance efficiency were based on its sub-characteristics. Another metric was security, and it measures how the system can protect the user's data and other confidential information inputted on the system (Kaur et al., 2019). The security contains information's basic features such as confidentiality, integrity, non-repudiation, accountability, and authenticity. From these features, three indicators were derived. The last metric used in the evaluation is *usability*. Usability is used as a metric in other

software quality models (França & Soares, 2015). In ISO 25010, usability has the most attributes. Still, only three of those were the self-made indicator of usability derived. The three sub-characteristics are appropriateness recognizability, operability, and accessibility. Overall, there are three indicators for each criterion, with a total of 12 indicators.

DISCUSSION

System Design

The V-Locate app was developed through several clients and server-side scripting languages like PHP and JavaScript. The proponents also use CodeIgniter, a PHP framework for easy development and code optimization. The JavaScript library for interactive mapping named Leaflet was used to integrate the map on the web. A leaflet is open-source, and it supports the latest version of HTML and CSS. MySQL is used as a database to store the coordinates of every Vulcanizing Shops and spare parts store and the list of products and services offered. Figure 3 shows the system architecture of the V-Locate app. The system was designed as a web app to avoid issues of operating system compatibility. The app can only be accessed with internet connectivity. The user must enable their mobile phone's location for correct navigation display.

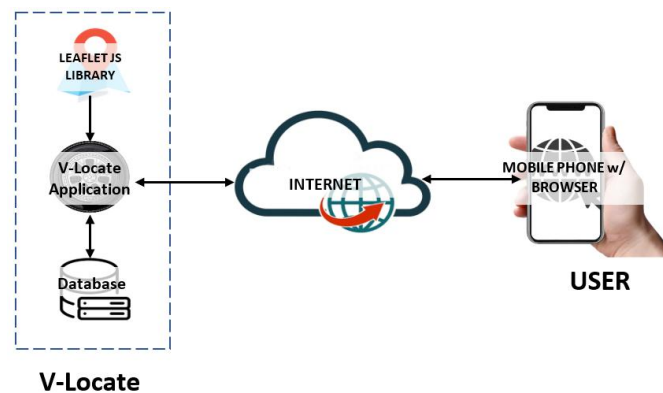


Figure 3. V-Locate System Architecture

System Interface

The V-locate user interface is simple and easy to manage. It is just like a common navigation app. However, it is intended only in locating vulcanizing shops and stores selling motorcycle and car spare parts.

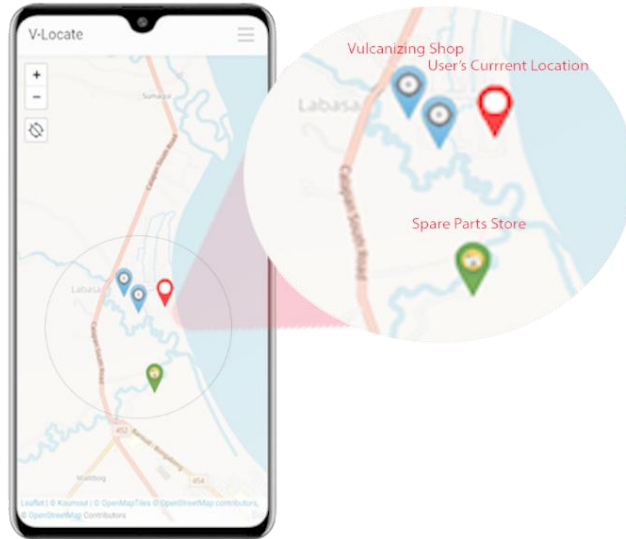


Figure 4. V-Locate User Interface

Figure 4 shows the start-up page of the application. Upon opening, the map will be automatically loaded with the user's location indicated by the red marker and all nearest vulcanizing shops represented by a blue marker. In contrast, the motorcycle/ car spare part store is represented by a green marker.

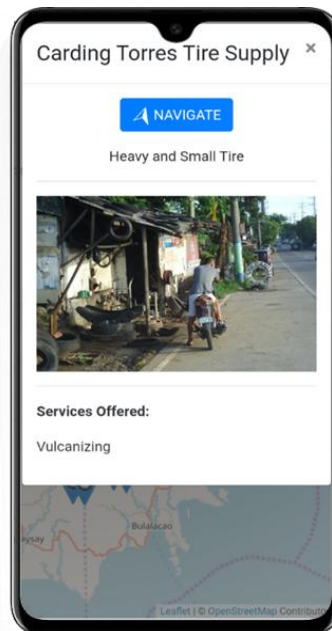


Figure 5. Displaying Vulcanizing Shop Service Offerings

Once the driver clicks the marker of the target vulcanizing shop, it will display the services that the shop offers as well as its available products shown in Figure 5. On the other hand, if the user clicks the spare part markers, it will give the same outcome. When the user clicks the Navigate button, the system provides a guide path to quickly locate the target shop, as shown in the following figure.

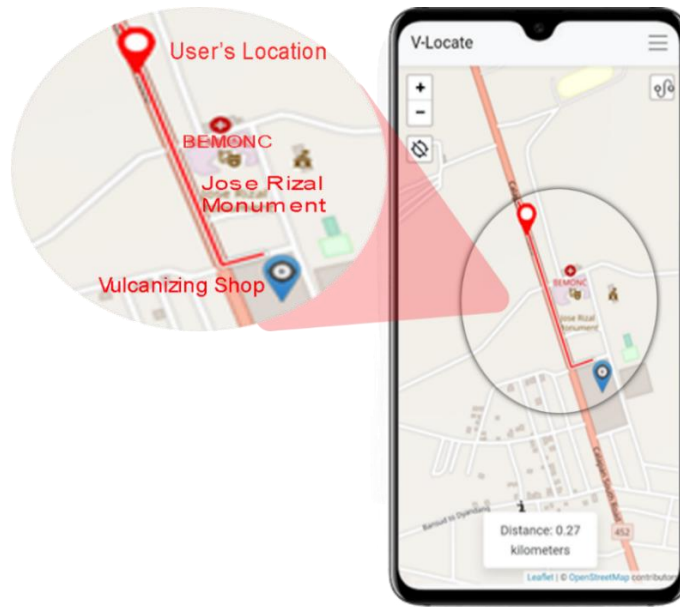


Figure 6. Route Guide to the Target Vulcanizing shop

The red line indicates the guide path, and the user must follow it to reach the correct destination. While moving, the red marker also moved in real-time. It also displayed the actual distance of the user's location from the target shop.

Evaluation Result

The system was evaluated with the devised evaluation instrument whereby four criteria were adapted from ISO 25010 software quality standards. Based on the result shown in Table 4, the respondents unanimously agreed that the system is functional, efficient, and usable and does not compromise any users' personal data.

Table 4. Summary of Evaluation Result

Criteria	Indicator No.	Mean per Indicator	Mean per Criteria	Overall Interpretation
Functional Suitability	1.	4.4	4.4	Strongly Agree
	2.	4.4		
	3.	4.5		
Performance Efficiency	4.	4.4	4.4	Strongly Agree
	5.	4.4		
	6.	4.4		
Security	7.	4.5	4.5	Strongly Agree
	8.	4.3		
	9.	4.6		
Usability	10.	4.4	4.3	Strongly Agree
	11.	4.2		
	12.	4.3		

To highlight the system's compatibility, the proponents provided the minimum relevant specification of the phone used by the respondents shown in Table 5.

Table 5. Required Minimum Specification

Hardware/ Software	Minimum Specification
Operating System	Android 5.0 IOS 7.0
Browser	Google Chrome Safari
Display	4.0 inches
RAM	2 GB
CPU	1.8 GHz Dual-core

With the minimum phone specification used in testing and evaluation, no display or lagging issues were identified. This result indicates that the system can run to a wide range of specifications of different devices. The only problem is the internet connection speed.

CONCLUSIONS AND RECOMMENDATIONS

The existence of Vulcanizing shop in a province like Oriental Mindoro is of great help to travelers when they meet emergencies like getting flat tires. And this kind of business must be tagged in a known navigation application to find the shop quickly. The development of V-Locate is significant because it provides the nearest location of the Vulcanizing shop and car spare part store in the 2nd District of Oriental Mindoro. It also recognizes the importance of Vulcanizing shops and promotes their product and services. The V-Locate app was found to be user-friendly and usable based on the evaluation conducted.

The system evaluation only focused on its usability and functionality. On that note, the proponents recommend further evaluation using the other criteria of ISO 25010. It is also crucial to undergo beta testing to identify real problems and improve the future version. Also, it is recommended to widen the scope of the map and make it offline since someplace has a weak internet connection.

IMPLICATIONS

The system evaluation shows that the developed system has great potential once implemented. It will ease the burden of travelers in Oriental Mindoro to find a repair shop in case of an emergency, which has a significant effect on the province's tourism industry. Moreover, it also promotes and recognizes Vulcanizing shop's existence as a local business in the province.

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