

ViewAd: Location-Based Advertisement System

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Abstract: A location-based advertisement system can allow users to view the advertisement in a specific area or location. Even though there are several methods to advertise, most of the methods are not efficient and high cost, especially traditional advertisements like billboard and newspaper advertisements. These costly methods may not be suitable for small and medium-sized enterprises. Nowadays, people can't live without smartphones; digital advertising will be a new trend. Digital advertising takes a low cost, saves space, and is more efficient than traditional advertising. This study aims to identify the requirements and develop a location-based advertisement system. The need and potential for a location-based advertisement system in marketing were investigated. The functional requirements were gathered by referring to similar applications and interviewing the small and medium-sized enterprises businessman about the views and opinions on current advertising methods. A prototype named ViewAd was developed following the system prototype development method. ViewAd was evaluated by testing its usability and ease of use based on users' perspectives. The result indicates that this application is useful and easy to use. Overall, the respondents were satisfied with this application.

Keywords: *location-based advertisement system, digital advertising, small and medium-sized enterprises*

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1. Introduction

Nowadays, having a good marketing strategy can improve the sales of a product and let the company gain more popularity. Advertising is one of the marketing strategies that can improve the sales of a company's product. Sometimes a good advertisement can significantly improve product sales and make a small unknown company famous in a flash. So, advertising a product in the right way and platform can bring considerable benefits to the company [1].

Before the advancement of technology, an advertisement was much more difficult as the advertiser needed to find a reliable source and pay a decent amount of money to advertise their products. Traditional advertising involves advertising through newspapers, magazines, telephone, radio,

television, and billboards. The cost for each advertisement may differ based on the size of the advertisement and the medium chosen for publishing. With the advancement of technology, the way of advertising is also constantly improving. Since the advancement of technology, people are increasingly relying on technology. People are starting to spend less time on newspapers, magazines, and television and focusing more on computers and handphones. Therefore, advertisement and marketing strategies are also transforming from traditional to digital forms [2, 3].

Mobile is the top choice as a digital advertisement platform since almost everyone owns a phone. Moreover, the average time for people spending time on mobile phones is much greater than what they spend time on other things. People use mobile phones to read news, socialize, play games, watch movies and buy things. Therefore, a mobile

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app is the most suitable way to advertise products nowadays [4].

A location-based advertisement system allows users to view the advertisement in a particular area or location. Using the location-based advertisement can put better focus on the potential customers. Advertising product to only a specific group of potential customers reduces the promotion cost but maximizes the profit. Furthermore, a location-based advertisement system allows advertisers to spread their advertisements around the area using real-time user location (GPS) and location history [5]. Therefore, this study aims to develop a location-based mobile App to help SMEs advertise their products/services at a reasonable cost and reach many customers.

2. Background

Advertisement is one of the strategies to promote and increase the sales of a company's products [1]. However, sometimes company spend many funds on traditional advertisements like newspaper and billboard, but this cannot maximize the company's profit, and yet it cost a fortune. It is not a small cost, especially for small and medium-sized enterprises [6]. Therefore, some of the high-quality products sold by small and medium-sized enterprises are not sold well because of a lack of budget to advertise their product.

A location-based advertisement system allows users to view the advertisement in a specific area or location. The location-based advertisement also allows firms to put better focus on potential customers. Advertising products to a specific group of potential customers based on their locations reduces the promotion cost but maximizes profit. In addition, this system allows advertisers to spread their advertisements around the area using real-time user location (GPS) and location history.

Maxis was the first company which provide a location-based advertising system in Malaysia. Their system uses cell location technology to publish advertisements in a specific location. Their system enables advertisers to select the demographic profile of their target customers, and customers have the choice to receive such notifications. However, their system only publishes advertisements and promotions to Maxis myDeals customers. The system was made specific to Maxis myDeals customers only, and other customers cannot use this service. Besides, Maxis' location-based advertising service is only available in certain popular malls in Kuala Lumpur, while the other places are not provided with this service [7]

The high cost of traditional advertisement methods and the limitation of Maxis myDeals customers make many small and medium-sized enterprises not have an excellent and efficient platform to advertise their products. So, to solve this advertising problem, this study is initiated and aims to develop and design a mobile application to allow advertisers to advertise and promote their products or services easily at a low cost.

3. Methodology of the study

The study was conducted following the System Prototyping SDLC method. The prototyping model is a method of system creation in which a prototype is designed, tested and then reworked as required until an appropriate result is reached from which to create the whole system or product. This model works best in scenarios where not all requirements for a project are known in detail beforehand. It is an iterative proof of trial and error between developers and users [8, 9]. There are four processes of system prototyping, as illustrated in Figure 1.

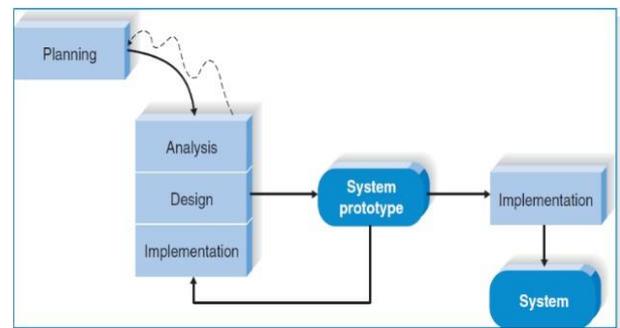


Figure 1. System Prototyping Methodology

In the planning phase, a problem was identified in the advertisement system nowadays, where traditional advertisement platforms (newspaper and billboard) are too expensive and inefficient for small and medium-sized enterprises. At this stage, a plan is proposed to develop a system that can advertise to users in a specific area or location. A project proposal is drafted explaining the problem of the traditional advertisement system, the project's objective, the project's significance, the project's scope, and the project's schedule. In the analysis phase, the requirements of the location-based advertisement system were analyzed by conducting a requirements analysis process. The activities involved in this phase are identifying the functional and non-functional requirements for the location-based advertisement system, and the use case diagram was drawn to represent the functional requirements. The requirements were gathered by analyzing the weakness of the traditional advertisement system, analyzing the similar system, Maxis' location-based advertising system. The requirement specifications were detailed in this phase.

In the design phase, Flutter was used to design the application's interface. Dart is the programming language that was used in Flutter. The database for the location-based advertisement system is Firebase. The location-based advertisement system is hosted on a cloud web server. In addition, a class diagram and sequence diagram were created to represent the system requirement. The class diagram shows the relationships between essential concepts in the problem domain. Sequence diagrams show the details of the interactions between the objects carried out to implement the functionality of the use cases. For example, a sequence

diagram can depict the chronologically structured event flow through a use case.

In the final stage, a low-fidelity prototype was developed. First, selected users evaluated the prototype to gather suggestions for improvement. Then, a high-fidelity prototype was developed by considering the comments and suggestions from the users to satisfy all customers' requirements.

4. Design and development of ViewAd

This section describes the design and development of a mobile app for advertising and viewing advertisements following the System Prototyping SDLC method. First, the requirements are gathered and analyzed. The analysis outcome is represented using a list of requirements and UML diagrams. Second, the solution is designed and modelled using mainly a class diagram. In addition, the user interface is designed to implement the user interaction with the prototype they satisfy the requirements.

In the requirement gathering process, two methods are (1) interviewing the people who have experience advertising products and (2) analyzing documents and apps from the Internet that are related to advertising advertisement. Table 1 shows the list of requirements.

Table 1. List of requirements for ViewAd

ID	Requirement Description	Priority
1	Register Account	
1.1	A user shall be able to register to the app by entering email, password, phone, address, etc.	High
1.2	If compulsory fields are not completed, an error message, "Please complete" will be displayed on a pop-up window.	Medium
2	Login Account	
2.1	Users must log in to ViewAd by keying in the correct email and password.	High
2.2	Advertisers can request a password reset if they forget their password.	Medium
2.3	The system will display "Email or password incorrect" if the user inserts an incorrect email or password.	Medium
3	Advertise Advertisement	
3.1	Advertisers insert the detailed information of the advertisement, like the title of the advertisement, description of the advertisement, location, period of the advertisement	High
3.3	Advertisers can cancel the procedure at any time by clicking the 'Cancel' button.	Medium
4	Manage Advertisement	
4.1	Advertisers can cancel the advertisement before making payment.	Medium
4.2	Advertisers can delete the advertisement.	Medium
5	Manage Profile	
5.1	Advertisers can view their personal information.	Medium
5.2	Advertisers can edit their profile information such as company/business name, address, phone number, and so on.	Medium
5.3	Advertisers can delete certain information from the profile.	Medium
5.4	Advertisers can cancel changing their information anytime by clicking the 'Cancel' button.	Medium
6	Make Payment	

6.1	Advertisers can make payments online.	Medium
6.2	The system will display an error message 'Bank Account Not Available' when the advertiser inserted the wrong information.	Medium
6.3	Advertisers can cancel or make payments anytime by clicking the 'Cancel' button.	Medium
7	View Advertisement	
7.1	Viewers can view all the advertisements within a certain area.	High
7.2	Viewers can view the details of the advertisement such as description, related company/business, address and so on.	High
7.3	Viewers can view the advertiser information of the Advertisement.	Medium
8	Verify Advertisement	
8.1	Admin can view the details of the advertisement posted by advertisers.	Medium
8.2	Admin can approve/decline advertisement posts by advertisers.	High
8.3	Admin can block advertisement posts by advertisers.	Medium

The requirements presented in Table 1 were translated into the computer system functionality. The following process is visualizing and modelling the app's requirements using the appropriate modelling method and tools. In this work, the Unified Modelling Language (UML) was used. Two behavioural diagrams, namely use case and activity diagrams, were created to model the requirements in the analysis phase, and a class diagram was created to represent the structural components of the app in the design phase. The diagrams were drawn using STAR UML. Figure 2 illustrates the use case diagram and the communication between the use cases and the actor for a mobile app that can be used to advertise and view advertisements.

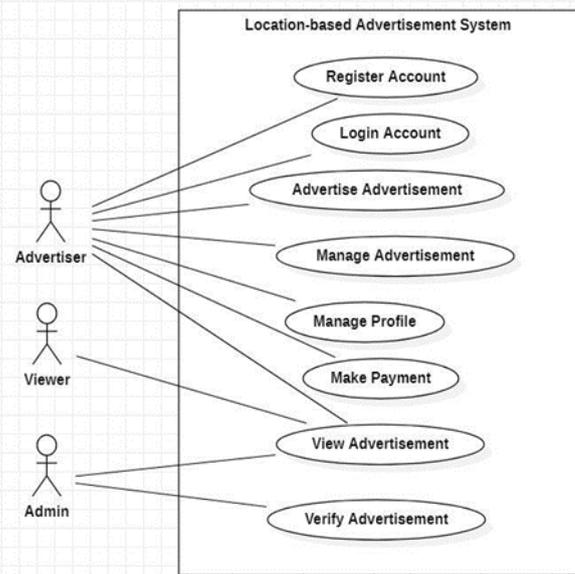


Figure 2. The use case diagram of ViewAd mobile app

The use case diagram is detailed to show the mobile app's behaviour. After that, a self-explanatory activity diagram illustrates the operations involved in using the mobile app to advertise and view advertisements (see Figure 3).



Figure 9. Main Screen(Viewer)



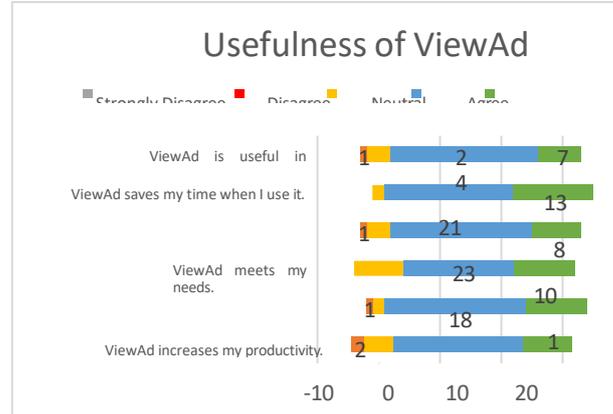
Figure 10. Ads Details(Viewer)

6. Evaluation of ViewAd

A usability test was conducted to evaluate the effectiveness and usability of the location-based advertisement system (i.e., ViewAd). Thirty-six respondents participated in this evaluation study. A set of post-task questionnaires was prepared by using Google Form and distributed to the respondents via WhatsApp. Post-task questionnaires are completed immediately after finishing a task and capture participants' impressions of that task [10]. In addition, the prototype of the location-based advertisement system was uploaded to google drive as a .apk file and shared with the respondents. The post-task questionnaire provided a link for the .apk file's, test procedure and evaluation questions. Respondents can download the .apk file via the provided link and test it by following the test procedure. After the test finished, participants were required to evaluate the system by answering the post-task questionnaire. If there is any question, the respondents can ask the developer through WhatsApp or Webex.

Analysis of the respondents' demographic information revealed that the gender of respondents involved in this study is 50% male and 50% female. 72% are between 21 to 25 years old, and 94% of respondents used mobile apps daily. According to the evaluation, 45% of respondents had never heard about a "location-based advertisement system", 33% had heard about it and 22% had a little impression. 56% of respondents have experience with advertising products; 61% prefer to advertise their product through social media marketing, and 39% preferred to purchase online advertisements. 33% of respondents have experience with using a similar app (location-based advertisement system), and 67% do not have experience in using a similar app.

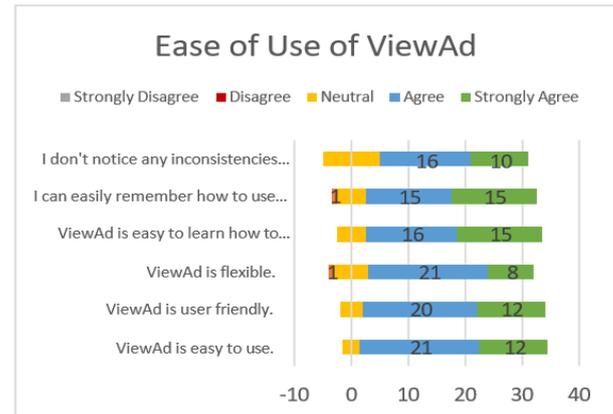
Figure 11 shows the evaluation of the usefulness of ViewAd. As it can be seen, many of the selected respondents agree and strongly agree in response to the items related to the usefulness of ViewAd. Respondents think that ViewAd



is useful, and it can bring some convenience to them. Only 1 or 2 respondents disagreed with the application's usefulness.

Figure 11. The respondents' perspective on the usefulness of ViewAd

Figure 12 shows the respondents' perspectives on the ease of use of ViewAd. As seen, most of the selected respondents agree and strongly agree based on the scale provided to assess the ease of use of ViewAd app. In addition, most of



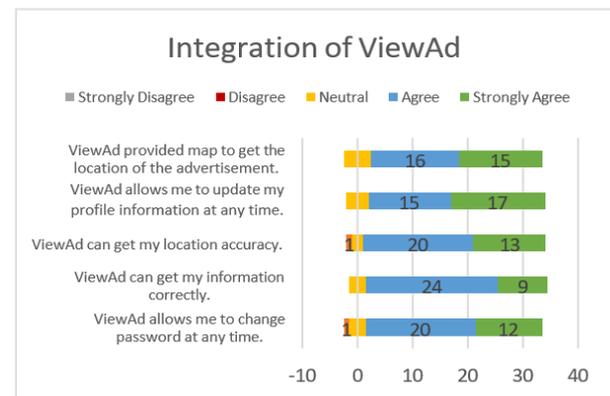
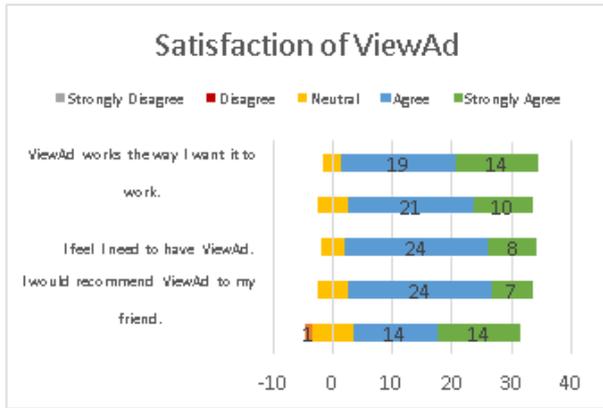
them think that ViewAd is easy to learn and use. Only one respondent disagreed that ViewAd can easily remember how to use and flexibly.

Figure 12. The respondents' perspective on the ease of use of ViewAd

Figure 13 shows the satisfaction of respondents towards ViewAd. Most of the respondents selected agree and strongly agree on the scale provided. Only one respondent disagreed with the question "I am satisfied with ViewAd". Although most of the respondents were satisfied with ViewAd, 20% of respondents selected neutral on the question "I am satisfied with ViewAd". It means ViewAd still need to make some improvement.

Figure 14 shows the respondents' perspectives on the integration of ViewAd. There is a large number of respondents agreed on this integration aspect of the application. They are satisfied with the functions and features provided in ViewAd. They think the function of ViewAd has met their requirement. Only one respondent disagreed with

the accuracy of the location and the change password



function.

Figure 13. The respondents' satisfaction with ViewAd

Figure 14. The respondents' perspective on the Integration of ViewAd

7. Conclusion

This paper described the design and development of a mobile app for ViewAd: Location-based Advertisement System. However, there are still many defects in the ViewAd interface of ViewAd to make it more user-friendly and change how it advertises the advertisement by using the current location to the location that users can choose. Besides that, we also hope that we can cooperate with other

companies to let the user receive the advertisement on our app and view the advertisement on the third-party application.

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