Establishment of Ambient Media Advertising Order Snatch System Considering Price Stepping (PPA) Algorithm

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Abstract. With the rapid development of modern information society, all types of advertisements emerge in an endless flow, where ambient media that emphasizes the multi-sensory experience of users rise as the times require. In this paper, based on the price stepping algorithm, a new ambient media advertising model based on O2O that integrates offline large-screen resources is proposed to further promote the development of ambient media in modern society. The practice demonstrates that the penetration of ambient media advertising into the living environment allows consumers to remember them more quickly.

Keywords: Price Stepping · Ambient Media Advertising · Order Snatch System

1 Introduction

With the rapid development of modern information society, various advertisings are emerging. Major brands use various methods to promote their products and compete for eye-catching. In this environment, the influence of traditional outdoor advertising is gradually declining, and ambient media that emphasizes the multi-sensory experience of users emerges. In daily life, buses are frequently-used means of transportation. The bus station advertising is not restricted by time and region. It faces a broad audience, and its information spreads widely [1, 2]. Once the bus stop advertising is established, it will be effective for a long time. Over time, people's impressions will deepen, the effect of communication will be better, and it will play a direct communication role with consumers. Studies have shown that 74% of consumers go out to travel by buses, the average frequency is 20 times a month, at least 16 h: waiting room advertisings are divided into ordinary consumers with a 50% share of the market except for TV The most exposed advertising media outside [3, 4]. At present, many brands are not satisfactory in the promotion of advertisings. Many advertisings only focus on the visual and sound and ignore the established fact that people have five senses [5]. However, there are still many excellent ambient media advertising cases that not only stop at visual effects. They combine multiple senses to offer users a refreshing feeling [6, 7]. The concept of "ambient media" originated in Europe. Mark Austin and Jim Aitchison summarized the definition of "ambient media" in the book "Is anyone out there", i.e., something suitable for spreading advertising information, which can be used for writing, coloring, and hanging, and anything that can be used to convey brand connections [8, 9].

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To exert the role of ambient media in life more effectively, based on the price stepping algorithm, a new ambient media advertising model based on O2O that integrates offline large-screen resources is proposed in this paper to further promote the development of ambient media in modern society. The penetration of ambient media advertising into the living environment allows consumers to remember them more quickly.

2 Price Stepping Algorithm

The ideal advertising budget of advertisers is directly proportional to the advertising transaction volume, and the advertising transaction volume is closely related to the advertising period and the advertising area. To predict the advertising transaction rate in a certain period or a certain region, we established a linear regression model based on historical data to fit the advertising transaction probability p(t) in each period and the advertising transaction probability p(d) in each region.

$$h(x) = \sum_{i=0}^{n} p(t)_i x_i = p(t)x \tag{1}$$

where $x_1, x_2, \cdots, x_n$ is the total daily transaction volume, and h(x) represents the transaction volume during the t period of the day.

$$g(x) = \sum_{i=0}^{n} p(d)_i x_i = p(d)x \tag{2}$$

where $x_1, x_2, \cdots, x_n$ is the daily transaction volume, and g(x) represents the transaction volume in the d area of the day.

The fitted p(t) and p(d) are only used to predict the next day's advertising order transaction. When a new advertising transaction occurs, the advertising transaction rate needs to be continuously adjusted in accordance with the new data to calculate the continuous Ad transaction rate.

The value of advertising orders in different delivery periods is different, and advertisers' demand for delivery during prime time is higher than that of unpopular periods. The system adopts a relatively high pricing strategy during prime time when competition is high, which can better match the value of this time period and bring higher returns to equipment owners. This paper defines that the competition degree measurement based on the delivery period can reflect the gap between the delivery amount in this period and the average delivery amount per unit period. The difference is shown in Eq. (3):

$$\partial(t) = \frac{tv(t) - \overline{tv}}{\overline{tv}} \tag{3}$$

where tv(t) is the delivery volume of the period, and represents the average delivery volume of the period. As the value of tv(t) is not available when the order is generated, the transaction prediction probability p(t) at this time period needs to be used, as shown in Eq. (4):

$$\partial(t) = \frac{p(t) * \overline{v} - \overline{tv}}{\overline{tv}} \tag{4}$$

where $\overline{v}$ represents the average daily delivery volume. At this point, $\partial(t)$ represents the change trend of the degree of competition with time. When the delivery volume of this period is close to the average delivery volume of the period, the value is 0, the high competition period value is greater than 0, and the low competition period value is less than 0.

In the competitive relationship of the same delivery period, various delivery areas also have different delivery volumes. Taking a relatively high pricing strategy in hot areas with high competition can balance the market.

3 Overall Design of the Client

Through the demand analysis of ambient media advertiser clients, the functions of advertiser clients are divided into the following five modules: advertising module, order management module, user management module, statistics module and setting module. To realize the functions required by the user, the client also needs the support of the network module and the storage module. The overall structure is shown in Fig. 1.

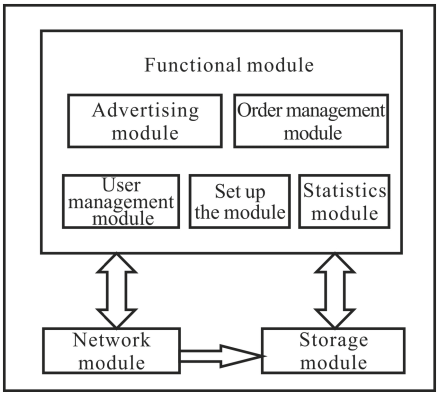


Fig. 1. Overall architecture of the ambient media advertiser client

The user management module provides account management functions such as registration, account password login, and third-party login. After the advertiser logs in, the user management module can also be used to add or modify personal information and modify the password.

The ad serving module provides users with an entrance to publish advertising orders, including uploading advertising resources and publishing orders. Advertisers can choose to upload image ads or upload video ads. Uploading image ads supports album selection and instant shooting [10]. Multiple pictures can be uploaded simultaneously, and the upload progress can be viewed. The upload of image ads also requires the settings of the image rotation time, uploaded video ads support album selection, and recording, and it can only upload a video during the upload process. Advertisers also need to fill in the title, introduction, delivery time, delivery area, and other information of the advertising.

The order management module displays the details of all orders, including order information and advertising information. The order information includes order status, order release time, etc. The advertising information includes the display of thumbnails of the advertising resources, the advertising area, and the advertising period. The order management module can also manage the delivery status of orders and the local storage status of orders.

The statistics module is used to display the information collected by the set-top box, such as the flow of people. The advertiser client uses a list to display the flow of people for each successful order. It is convenient for advertisers to quantify the advertising revenue.

The setting module can clear the cache, view the client version number, developer information, and update the client function.

The storage module is used for the analysis and local cache of user information, advertising information, order information, etc. It provides data interface support for the functional modules.

The network module is responsible for communicating with the server, providing functions such as uploading advertising resources, uploading orders, and obtaining statistical data.

Through the above analysis of the functional modules of the advertiser client, and the analysis of the iOS architecture in the previous section, the overall framework of the advertiser client can be obtained, as shown in Fig. 2.

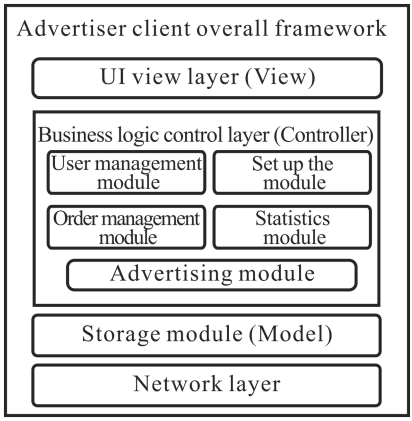


Fig. 2. Four-layer framework diagram of ambient media advertiser client

As shown in Fig. 2, the advertiser client's framework is divided into four layers, the view layer implements the client's UI presentation, and user interaction response, the business logic control layer implements the logical processing of five business function modules. The storage layer mainly performs data processing. Parse and encapsulate different persistence methods for different data. The network layer is mainly responsible for communication with the server and implements network status monitoring and data encryption.

4 Implementation of the Ambient Media Advertising Order Snatch System

Advertisers place advertisements on the advertiser's client. Advertisers can upload images to the server by selecting or recording pictures or video resources, and enter information such as the name of the advertising, the profile of the advertising, the area where the advertising is served, and the time of delivery.

Applications can use cameras and photo libraries through image pickers. The image picker interface is implemented by the UI Image Picker Controller controller class, which inherits from the UI Navigation Controller class and can be used to select photos and record videos.

The XS Upload Controller class is a control class for selecting or recording all advertising resources. It must implement the UI Image Picker Controller Delegate protocol and the UI Navigation Controller Delegate protocol. It connects the image picker, the XS Upload View, XS Request Model, and XS Request Data Manager, the interactive model of the ad delivery network, to control the entire process. This controller class creates an instance of 5 songs, 8 £ 6, 1 ^ 11 ∈ 0, and 0111", and specifies the commission. Based on the user operation, the image source is specified, and at the same time, the user wants to select whether the image or video is selected, and controls the image. The picker selects or records, and saves to the album after recording.

The XS Upload View class is a view class for advertising. This class draws the UI layout presented to the user, such as the button btn Choose Pic for uploading advertising resources, the prompt information label, the text summary for the advertising introduction, the date picker, etc. Some methods of operating the control are designed, such as the click event of the select time button design click trigger event show Date Picker (), this method implements the click time button, the time selector pops up. When the time is selected on the time picker, the date Picker Value Changed () method is triggered. XS Upload Controller refers to the XS Upload View class to implement the methods provided.

The XS Request Model class is the data model for the entire advertising. Its attributes include advertiser ID, ad Name, ad Abstract, delivery start time begin time, delivery end time end time, delivery address Name, etc. The information entered by the advertiser when the advertising is placed can be matched with the model object. The XS Upload Controller class uses this data model as an attribute, processes the user input information obtained from XS Upload View, and stores it in this attribute.

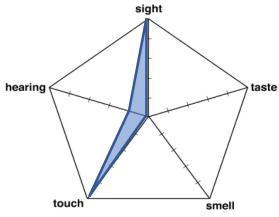
The XS Request Data Manager class is a network class that inherits AF Netwoking and is responsible for the implementation of the server interface. This class designs a method for uploading advertising orders to the server, which uses POST to communicate with the server. The XS Upload Controller class implements the singleton of the network class as an attribute, calls the method of the network class, and uses the value in the attribute request based on the XS Request Model class as the parameter of the interface method to perform network communication. If the network condition is poor, an exception is thrown, and a pop-up window prompts the user.

When the advertiser needs to upload a large number of advertising resources, the network interruption during the upload process needs to be considered. To improve user experience and avoid unnecessary waste of network traffic, the client implements a

breakpoint resume function. When using the HTTP protocol for network requests, the protocol will automatically upload large files in pieces, but if the network is interrupted during the upload process, we cannot get a breakpoint. After the network connection, you need to upload it again. Hence, when uploading locally, the large files are divided into pieces, such as 1M/piece, and the pieces are divided and uploaded to the server in sequence. After the server receives them, these small pieces are merged into the original file. At this time, the upload status of each piece is recorded locally, and when the network is interrupted and connected again, the local upload starts from the breakpoint to realize the continued transmission of the breakpoint.

Use the UI Image Picker View to obtain files and save them in the XS Ad File class. The attributes of this class include file type, file path, file name, file size, the total number of slices, and thumbnails. Use the read Data With Chunk method to fragment the file, and each fragment records the status of the upload, waiting means uploading, loading means uploading, and end means uploading has been successful.

Table 1. Ambient media advertising on bus platforms

	Vision		Hearing	Tactile	Sense of smell	Taste	Five senses
	Morphology	Color	Voice	Material	Smells	Taste	
Approach	●	●	○	○	○	○	
Entrance	●	●	○	●	○	○	
Interactive	●	●	●	●	○	○	
Leave	●	●	○	●	○	○	

The process of uploading to the server is as follows:

1) The client sends an upload request to the server. The request parameters include the uploaded file name, file size, and other information.
2) After the server approves to upload, it generates an identifier to identify the upload session and returns it to the client.
3) After the information is received, the client starts sharding and records the upload status in the sharding. Information such as the identifier returned by the server, the starting position of the fragment, and the size of the fragment are appended to the upload information.
4) After the fragment is received, the server validates the fragment ID and size. If the verification is passed, the server stores the fragments and returns the correct response to the client. If the verification fails or the message is not received for a long time, the error message is returned to the client.

5) After the correct response is received, the client changes the upload status of the shard to finish and repeats steps (c) and (d) to upload the remaining shards in multiple threads. If you receive an error message from the server, an exception is thrown. Wait for the next upload.
6) When upload again, the client skips the shard whose upload status is finish, and only uploads the shards in the wait and load status to realize the resuming of the breakpoint.
7) After all the file fragments are received, the server merges the fragments in order, restores the source file, encrypts the file, and calculates the verification code. The server returns the message that the file upload was successful to the client. The client clears the shards and completes the upload of large files. Table 1 shows the ambient media advertisings are placed for bus platform order snatchs.

5 Conclusions

In this paper, based on the price stepping algorithm, we proposed a new ambient media advertising model based on O2O that integrates the functional modules of advertising master client and device master client. The frameworks of the two master clients are designed respectively. At the same time, the ambient media advertising order snatch system is constructed. The offline large-screen resources are integrated to further promote the development of ambient media in modern society [11]. The penetration of ambient media advertising into the living environment allows consumers to remember them more quickly.

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