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Computational Marketing Model and Heuristics for Mobile Adverts

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Abstract -*The mobile industry is one of the fastest growing industries in the world. A new type of advertising, mobile advertising, has come up through the advent of this new technology. The problem with this type of advertising at the moment is that irrelevant adverts are being sent to people. These in turn become irritating to the consumers, therefore the adverts are wasted. This research looks at the use of a computational marketing model and heuristics for the dissemination of adverts to the target group which is interested in that particular category. In this research we compared the marketing models currently being used as well as mobile advertising algorithms and combined their best traits into the design of the model implemented in this research. The results of the research show that it is possible to disseminate specific adverts to a target group to whom there is relevance, instead of wasting resources by broadcasting everything to everyone.*

Keywords: Computational marketing, Heuristics, Mobile marketing

1. INTRODUCTION

The business environment today has become more competitive and more complex making it even harder for businesses to stay ahead of their competition. New methods and tools are being searched for to help businesses take better strategic decisions in order to maintain their competitive advantage and acquire higher market share [1]. In the mobile era, mobile advertising is essential and has been developing incredibly fast. All over the world, almost everyone owns a mobile device. Marketers are eager to turn to mobile advertising for benefiting from initially targeting customers [2]. There are several marketing models that may be used such as computational marketing model, algorithmic marketing and marketing engineering strategy. Computational marketing can be defined as the application of computational science techniques to model and understand market behaviour [3]. It can also be defined as a set of techniques for finding the best match between a user in a given context and a suitable survey [4]. Personal advertisements are the next-generation in the world of advertisement. Mobile advertising allows for any individual to come up with their adverts and send them to other people. The heuristics for mobile adverts are the intuitive or common sense way of advertising. Soft selling is an advertising strategy that uses images, emotions of people, symbols, or ethics to promote a product. A Computational marketing model and heuristics for mobile advertising need to be found to give businesses a competitive edge over others.

Viral mobile advertising taps into current social networks to spread a marketing idea. With the advent of viral mobile advertising, marketers are under pressure to advertise their products by showing pictures or video clips and getting response from potential customers from their mobile devices. The issue with this type of advertising is that these adverts might not be reaching the target group because there is no control on who receives these adverts.

It is difficult and sometimes impossible to generate up to date pictures or video clips of products for inclusion in advertisements in conventional advert media. The conventional advert media is the traditional places where adverts were placed before for example print media, such as newspapers, magazines, billboards and so on. The other places would be on the television as well as on radio. It is therefore necessary to have a specialised mobile app and Advert Server for processing the advertisements using a unique marketing model. For mobile advertising to be successful there is need for these three basic factors, consumer permission, personalisation and message content [5].

1.1 CURRENT SITUATION IN ZIMBABWE

The aspect of mobile advertising is a new phenomenon worldwide. In Zimbabwe, as an example, only 6.8 % of the population had mobile devices in 2006 up to 72% in 2011 though this figure could be misleading since many people own more than one SIM card [6].

According to Postal and Telecommunications Regulatory Authority of Zimbabwe (POTRAZ), the December 2012 (4th quarter) mobile phone and fixed telephone subscribers statistics, Zimbabwe's mobile penetration is now 97%, up from 85% in June 2012, [6]. The early models of mobile devices only had a SMS (short message services) platform. Advertisers could only create and send text based adverts or SMS. Now advertisers can send images and videos as well as interactive adverts to their customers. Mobile Advertising has become very popular in the world. It needs to be embraced and enhanced by the use of a superior marketing model so as to survive the competition out there. Currently other marketing techniques have the shortcoming of having periodic, stale and static advert content. There is a need to lure customers by up to date, exciting and relevant content.

Since mobile phones are very personal devices, mobile advertising is often regarded as intrusive, although relevance and added value such as discounts and special offers can increase consumer acceptance. Consumer acceptance was found to be significantly correlated with whether the consumer is interested in the campaign, campaign relevance, and monetary incentives.

Perceived enjoyment, usefulness of the services and expressiveness, or clarity, has had a strong overall impact on consumers' intentions to use mobile services. Entertainment value and information value are the strongest drivers of mobile advertising acceptance, [7]. It is argued that consumers develop a positive attitude towards mobile advertising, which in turn leads to the behavioral intention to use mobile service, only if mobile advertising messages are creatively designed and entertaining, or if they provide a high information value.

1.2 JUSTIFICATION

The traditional marketing strategy of advertising on the press, billboards and broadcasting on radio and television has limitations of product presentation space and not targeting interested customers. The development of a computational marketing model is a novel way to gain competitive advantage over other products as it can allow us to determine which customers to target with which adverts based on their profile.

In this research we use an android phone and an Advert server. The word client incorporates our advertiser as well as the customer, because for one to be able to advertise, one has to be registered. Whoever has registered for our app gets adverts of interest to them regularly.

2.0 LITERATURE REVIEW

It is important to describe and define the different components to the research. There is need in this section to review the literature that focuses on the different relevant marketing models available and available algorithms for the mobile advertising. From there, conclusions can be drawn on what the characteristics of a good model for this research are.

For mobile marketing to be successful there is a need for a number of factors to be considered and these are illustrated in Figure 1.1 which shows the influences of mobile marketing.

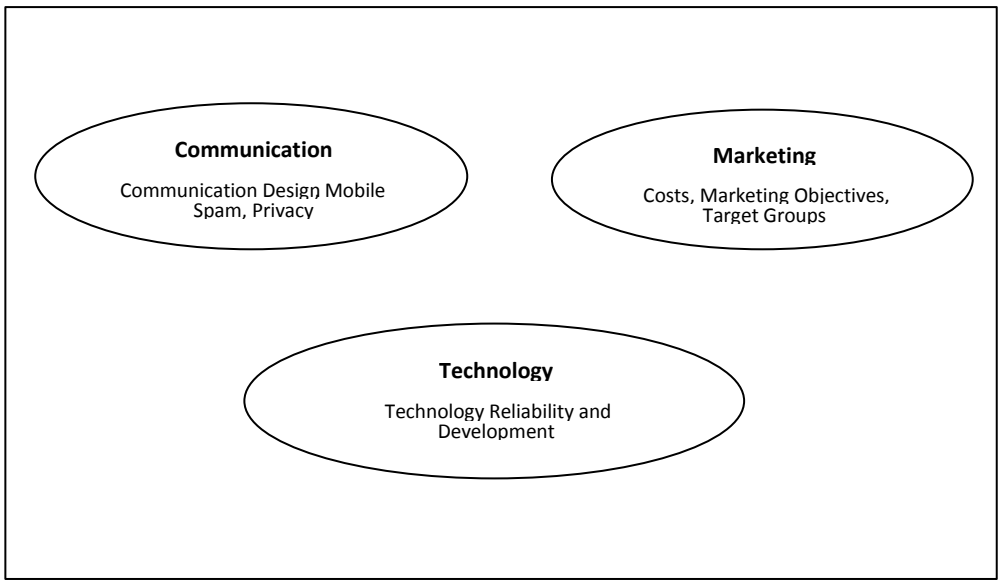

Figure 1.1: Influences of Mobile Marketing [8]

Mobile marketing is affected by communication, marketing and technology for it to be successful. Each category is expanded in the subsequent subsections.

Communication

Communication comprises of Communication design, Mobile Spam and Privacy. Communication Design- When looking at advertising, either entertainment value or the informative value of the message is essential. People want interesting content that is relevant and fun. This is very important. One goal of marketing is to make the consumers feel compelled to buy. There is

a need to understand a specific target segment of the market and create the service or campaign that appeals to that specific target group. Consumers invest in information and entertainment services from companies who can deliver services or products quickly, simply, and at a good price, [8]. Communicating with the consumer using entertaining, relevant and/or personalized content is not a guarantee for success, but it gives the mobile marketing much higher chance of succeeding than otherwise.

Communicating with the consumer requires prior consent. This consent is needed before any contact is made via the mobile phone. Therefore the campaign needs to be integrated with other media. Consumer trust is a corner stone of achieving full consumer acceptance of mobile marketing. Gaining consumer trust is complicated, where being transparent is an obvious advantage. It also seems to help if the campaign is promoting a strong and well known brand.

Mobile Spam- Spam, as a phenomenon, is unquestionably a source of irritation for many and it most definitely affects the success of mobile marketing. Spam is unsolicited or bulk electronic messages. Without prior approval from the customers, advertising messages are usually ineffective, and at worst could reduce brand equity by causing resentment. The offences from some companies who send spam messages may create a backlash that could harmfully affect the industry as a whole. At the moment mobile spam is not as much as the one found in emails, but this area is still under research.

Privacy-The personal nature of the mobile phone together with its ability to hold personal information and also communicate with other known or unknown parties brings up the issue of privacy protection and privacy intrusion.

At the moment operators seem to take the matter seriously since their main source of income is from their subscribers. In all probability the subscribers are still the most important customer, but the telecommunication operators might be inclined to lower the bar of privacy protection somewhat in exchange for monetary payments from sources other than the subscribers.

Marketing

Marketing involves costs, marketing objectives and target groups

Costs- This particular area is paramount to the success of mobile marketing. Today there are several examples of mobile marketing campaigns that are successful in terms of ROI, but it is likely that there are just as many that fail.

Mobile marketing can clearly satisfy the awareness objectives and most likely conversion as well. The effectiveness of the campaigns and how well the marketing objectives are met, depend on several factors but there was also a strong dependency on the value of the incentive given to the consumer. If the first prize in a mobile competition is disproportionally high, it is likely the competition is going to get noticed and the response rates and recall rates would become very high regardless of the marketing objectives that are supposed to be met.

Target Groups- An important success factor for mobile marketing would be the ability for the medium to reach the target groups of the marketer. Teens and young adults are usually very hard to reach with traditional marketing attempts; given their aversion to being explicitly advertised to, hence they are below average in media consumption, and above average mobility. Considering especially that the penetration of mobile phones is very high in the youth segment, young people have shown a very favorable attitude towards mobile advertisements. These facts make the mobile channel very suitable for reaching this target group.

The only thing that could be stated as a certain fact today is that mobile marketing works for teens and young adults. Hence, it is also towards that age group the current mobile marketing campaigns are aimed most often. This fact is most likely due to the high mobile knowledge and mobile penetration in this segment.

Technology

For mobile marketing to be successful, all technological aspects should be considered. These include the security of the transmissions, the limitations of the wireless devices, or the transmission reliability. Technology is evolving so the important conclusion is that there are new alternatives emerging and perhaps there are future technologies that solve the problems that mobile marketing face.

2.1 MARKETING MODELS

Mobile marketing has the potential of reaching the targeted consumers today. There are three types of strategies that can be used. There is the pull strategy, the push strategy and the viral strategy. In the pull strategy, consumers explicitly request for goods or services from marketers. In the push strategy, marketers distribute or communicate content to the consumers. In viral strategies, there is exchange of information among consumers, [9].

Below are some of the mobile marketing models which are currently in use: Mobile viral marketing, also known as mobile word-of-mouth, refers to oral communication from communicators to recipients who do not see it as a commercial product with a brand, product or service. Basically viral strategy targets a limited number of users on social networks using incentives, and they in turn invite their friends, [10].

- Direct Marketing, where product information and special offers can be sent for instance via SMS to customers and prospective clients who have opted in to receive such messages. For instance, a bank may decide to directly promote their first-time homebuyer mortgage program to only newlywed customers. In accordance with the general principle of marketing, a direct marketing campaign aims to maximise net profit.

- Special promotions let the consumers take part in competitions and win prizes. For instance, when a new movie hits the box office, an SMS campaign could be launched allowing customers to win tickets to the premiere.

- On-pack promotions is when a mobile number is printed directly on packaging material and customers are invited to send text messages to receive information, give feedback, or take part in a competition.

- Computational marketing uses algorithms to come up with semi-automated marketing. Computational advertising is finding the best between a given user in a given context and a suitable advertisement.

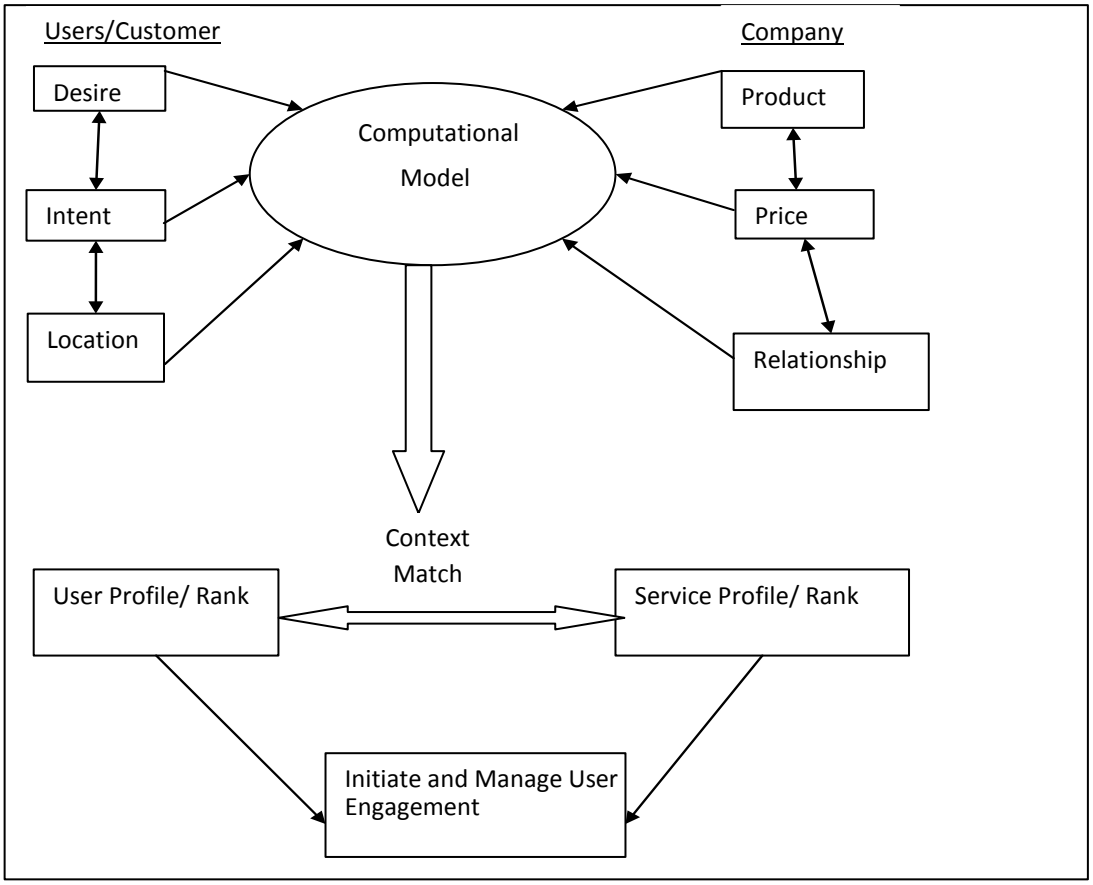

Figure 1.2 Algorithmic Model

Figure 1.2 illustrates the Algorithmic model. The users or consumers need to have a desire for the product. This would involve, what they are looking for, where they are getting the product from, the image of the consumer, that is, what the product says about them. The other issue is the intent. It looks at the time frame and price range of the consumer. Location is about where the consumer is and in what context.

2.2 ALGORITHMS

An algorithm is a procedure to accomplish a specific task. An algorithm must solve a general, well-specified problem. An algorithmic problem is specified by describing the complete set of instances it must work on and of its output after running on

one of these instances. Algorithms are like road maps for accomplishing a given, well-defined task. There are several types of algorithms which are being used for advertising and these include the ones in the following section:

2.2.1 Microsoft Association Algorithm

The Microsoft Association algorithm is an association algorithm that is useful for recommendation engines, these recommend products to customers based on items they have already bought, or in which they have indicated an interest.

The algorithm uses association models which are built on datasets that contain identifiers both for individual cases and for the items that the cases contain. A group of items in a case is called an item set and an association model consists of a series of item sets, which are a group of items in a case, and the rules that describe how those items are grouped together within the cases. The rules that the algorithm identifies can be used to predict a customer's likely future purchases, based on the items that already exist in the customer's shopping cart, Microsoft (2013). For example, if a customer buys bread, milk and eggs, the prediction would be to include sugar, coffee and tea as likely future purchases. This algorithm is a type of Apriori algorithm.

2.2.2 Programmatic buying

It began as a way for advertisers to place lower-cost adverts for products like teeth whitening products and slimming pills that filled up the back pages of Web sites, but the practice has gained in sophistication and size, with major advertisers and many of the world's largest advertising agencies creating private exchanges to automate the buying and selling of adverts. Programmatic buying includes a number of different technologies and strategies, but it essentially allows advertisers to bid, often in real time, on advert space largely based on the value they have assigned to the consumer on the other side of the screen. For example, Nike wants to sell running gear to a particular consumer who has a high likelihood of buying shoes based on the data it has collected which also includes the type of Web sites that consumer typically visits. Ad-buying is done through computer trading therefore the price for that space can change rapidly.

The auctions take place in milliseconds as advertisers bid on the right to show you an ad immediately after you open an app or click to a new web page. On the desktop it's a powerful technique to deliver the right ad to the right person at the right time and place

2.2.3 Display Advertising

Similar to programmatic buying, Display advertising is defined as showing graphical adverts on regular web pages, as opposed to textual ads on search pages and is approximately a $24 billion business in 2006. There are two ways in which an advertiser looking to reach a specific audience can buy such ad placements.

One is the traditional method, where the advertiser enters into an agreement, called a guaranteed contract, directly with the publishers of the WebPages. Here, the publisher guarantees to deliver a pre-specified number of impressions matching the targeting requirements of the contract in the specified time frame.

The second is to participate in a spot market for display adverts, where advertisers can buy impressions one page view at a time: every time a user loads a page with a spot for advertising, an auction is held where advertisers can bid for the opportunity to display a graphical advert to this user.

2.2.4 Comparative Advertising

It is advertising where the advertiser advertises his goods or services by comparing them with the goods or services of another party. This is typically done by either suggesting that the advertiser's product is of the same or a superior quality to that of the compared product or by denigrating the quality of the compared product.

2.3 ADAPP COMPUTATIONAL MARKETING ALGORITHM

For our research we use a computational marketing model based on the advantages we picked from the existing models.

The algorithm has the following characteristics

- It is able to target the right consumer with the right information, that is the adverts the consumer has interests in are sent.
- There is suggested categories of interest based on the other areas one is or was interested in previously, therefore there is learning.

2.3.1 Heuristics

Heuristics are informal rules or shortcuts that are used to make everyday judgments, since one cannot afford to expend large amount of time and energy on every single detail or judgment in life. Therefore, they act as "rules of thumb" or simplifying strategies to aid in our reasonable guesses and judgments of events quickly.

Heuristics are of special relevance in situations with uncertain and incomplete information. In representativeness heuristic, people judge the likelihood that an event occurs according to previous results. The event appearing to be the more represented is judged as most likely. For this research, our criteria look for the most current adverts in a category. For non-registered viewers, the criteria utilises their location to give them relevant adverts.

3.0 METHODOLOGY

Software Development Methodologies

There are several methodologies that exist for software development. In the sections below we look at some methodologies which are available for mobile application development. The methodologies below are alternatives to the one chosen for this research.

3.1 Agile Processes

Agile Development Model is based on iterative development, where the entire software development life-cycle is broken down into smaller parts. The project scope and requirements are clearly laid down, at the start of the development process. This type of model is best suited for large size projects as it helps to minimize the overall risk and lets the project adapt to changes quickly.

3.2 Extreme Programming (XP)

It is a software development methodology which aims at improving software quality and responsiveness to changing customer requirements. As a type of agile software development, it attempts at having multiple short development cycles, rather than one long one which helps in reducing the cost of change or modification. This methodology is best suited for agile development process wherein large size projects are broken down into smaller units to facilitate the overall development process.

3.3 Incremental Model

Incremental model is a method of software development where the model is analysed, designed, tested, and implemented incrementally. The project focuses on analysis, design, and implementation of incremental model. The project also outlines a short brief about maintenance phase and various reasons for maintenance. The analysis phase is all about making a research and thinking of how to solve a problem; it is very significant to study the current system before one can start working on major changes. The design usually focuses on what programs are needed and a detailed plan of software components. Then lastly the implementation is when the project is completed and the software is installed at the customer site.

3.4 Rapid Action Development (RAD)

Rapid Application Design (RAD) is a software development life cycle which is most suitable for projects that are very urgent and need quick delivery. The structure of the RAD lifecycle is designed to ensure that developers build the systems that the users really need. The main objective of Rapid Application Development is to avoid extensive pre-planning, generally allowing software to be written much faster and making it easier to adapt to changing requirements. It is designed to give much faster development and higher quality results than the traditional life cycle.

The main importance of RAD is on building a prototype that looks and acts like the desired product in order to test its usefulness. The prototype is a vital part of the requirements determination phase, and may be created using tools different from those used for the final product. Once the prototype is approved, it is discarded and the real software is written.

This lifecycle, through the following four stages, includes all of the activities and tasks required to scope and define business requirements and design, develop, and implement the application system that supports those requirements.

The steps followed include:

Requirement Gathering - This step is also known as the Concept Definition Stage. At this stage, the business functions and data subject areas that the system supports are defined and the system's scope is determined. It consists of a review of the areas

immediately associated with our proposed system. This review produces a broad definition of the system requirements in terms of the functions the system supports.

Creating Design - The User Design stage consists of a detailed analysis of the business activities related to the proposed system. Key users decompose business functions and define entity types associated with the system. They complete the analysis by creating action diagrams defining the interactions between processes and data. Following the analysis, the design of the system is outlined. System procedures are designed, and preliminary layouts of screens are developed. Prototypes of critical procedures are built and reviewed. A plan for implementing the system is prepared.

Building Prototype -Also known as the Development Stage, this stage completes the construction of the physical application system, builds the conversion system, and develops user aids and implementation work plans. The software construction process consists of a series of design-and-build steps in which the users have the opportunity to fine-tune the requirements and review the resulting software implementation. This stage also includes preparing for the cutover to production. In addition to the tested software, the deliverables include documentation and instructions necessary to operate the new application, and routines and procedures needed to put the system into operation

Refine Requirement and repeat the steps -This stage includes final user testing and training, data conversion, and the implementation of the application system. The implementation stage involves implementing the new system and managing the change from the old system environment to the new one. This may include implementing bridges between existing and new systems, converting data, and training users. User acceptance is the end point of the implementation stage. This is when the users of the system are given a chance to test the system. If they are satisfied, they sign it off.

The selected methodology for this research is Rapid Application Development because

It embraces object-oriented programming methodology, which inherently fosters software reuse. Users and management see working, software-based solutions more rapidly than in Model-Driven Development

3.5 COMPUTATIONAL TIME

CPU time (process time) is the amount of time for which the central processing unit was used for processing instructions of a computer program or operating system as opposed to for example. Waiting for input/output operations or entering low-power mode. CPU time is measured in seconds calculated as follows:

$$\text{CPU Time} = \frac{\text{Average period of background task with no load}}{\text{Average period of background task with some load}}$$

The system's computation was tested on a Dell Machine with 2BG ram, core i3 and 2,6GH processor and the computational time for the system is given in table 4.6. Computational time obtained means that the more number of training images available in the database the more computational time but generally the system is efficient.

Number of training set in Database	Time taken for recognition
60	840ms
80	890ms

Table 1 Computational Time

4.0 RECOMMENDATIONS AND CONCLUSION

REALISATION OF OBJECTIVES

The aim of this study was to design and implement a computational marketing model supported by heuristics for dissemination of advertisements. The first objective was to develop an algorithm of computational marketing strategies for processing advertisements. In the literature review, we compared the marketing models which are currently available and used their characteristics to come up with our own algorithm for marketing of the adverts in analysis and design chapter. The implementation and testing was carried out in chapter six.

The second objective was to connect the application with the Advert server. This was done by creating a WiFi hotspot for the devices. We had to introduce another laptop as an access point and configure the network. The app when run connects to the

Advert server. The third objective was to implement heuristics for distribution of the adverts. This was achieved through the use of location for dissemination of adverts to guests and the use of the most current advert to the clients. The fourth objective was to upload adverts and disseminate them. When a registered user has created an advert, when he goes to the upload tab, he can put the details in and then upload them onto the system. After the administrator verifies the adverts, they are put on the database and distributed to the relevant clients.

Discussion of Results

In the literature review, we discovered that people find mobile advertising intrusive. There is more acceptance only if the advert is either entertaining or is of relevance to the individual. Our main angle for this research was to target relevance of the adverts. From this research we have come up with a computational marketing model which can be used to send relevant adverts to the target individuals, with the aid of heuristics to disseminate adverts.

Recommendations

The recommendations for future work is that the location of clients as well as guests can be automatically seen through the use of geo maps such as Google maps, therefore automatically sending adverts from that geographical area to the consumers. Another recommendation is to come up with an app which can work on any mobile device, such as on the iphone or the windows phone.

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