

Original Paper

Smart Urban Street Advertising Pattern Using Internet of Things Based on Environmental and Traffic Conditions

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Abstract

The rapid development of communications together with the growing usage of Internet of Things have recently provided an opportunity for transformation of information and created a new generation of advertising, called smart advertising. The main aim of this research work is to develop a pattern on smart urban street advertising to offer a meaningful connection between the “parameters received from the environment” and the “planned messages” displayed by smart billboards. The main idea behind the proposed pattern is to use a billboard which is capable of sensing parameters through environmental, thermal, visual and magnetic sensors. In order to investigate the existing relations between the advertisement patterns, a questionnaire has been developed and used to collect audiences’ viewpoints for selecting ads according to the criteria sensed by smart billboard. Using a sample size of 107, collected data have been analyzed to evaluate the overall vision on how to select ads through measurable criteria. Research results revealed that there is a significant relation between environmental and traffic parameters and the advertising contexts suggested by smart billboard. Therefore proposing smart billboards by detecting the environmental and traffic parameters can improve ads performance to attract the audiences.

Keywords

audience attraction, smart advertising, billboards, internet of things, street advertising

1. Introduction

Advertisements (mainly abbreviated as ads) play an important role in improving brand image and creating brand preferences in the minds of the audiences. They have the ability to run on all the physical elements in urban graphics such as billboards, stands, televisions, the exterior of subways,

buses and etc., that are subject to the audience's view (Khan et al., 2012). While street billboards are the greatest promotional tool in environmental advertising, with the increasing use of advertising billboards as the most effective elements, businesses and companies resort to intelligent display advertising by billboards to get more customers' attentions (Poulos & Pasch, 2015). Accordingly, billboards installed in different regions using Internet of Things technology have the ability to receive environmental parameters and also through the analysis of the data obtained can display advertising appropriate for the environment automatically and without human intervention. This scenario in today's world, despite the progress made in this field, has been the subject of a great deal of research. The process of this achievement can lead to a closer alignment of the set pattern to the current environmental conditions.

1.1 Internet of Things

The Internet of Things is a term in which objects will have the ability to interact with the user and other objects through communicative tools via Internet (Yang, 2014). This tool provides the ability to send and receive data through communication protocols for any category, such as humans, animals, and objects (Atzori et al., 2010). This technology is formed by integrating objects in the physical and digital worlds through wireless sensors (Lee I. & Lee K., 2015), in which physical objects with different computing and processing abilities develop the capability of image recognition, resource management and service, close communications, decision-making in the mode of connection, the information exchange with the manufacturer or other devices, and automatic decision making and also create intelligence in the system (Fleisch, 2015). In this technology, "thing" refers to any device that has a sensor for the exchange of information (Khan et al., 2012). It also supports different applications in various areas, such as health, environment, network, automobile industry, agriculture and animal husbandry, transportation, city, building, etc. This technology, based on the "machine learning" technique and the use of positioning sensors, infrared sensors, wireless local area networks, radio frequency, fast response codes, etc., allows the exchange of data, provides intelligible information about the communication environment, and manages all the operating sectors on the devices connected to the Internet so that objects are navigated automatically without human supervision and control (Lee I. & Lee K., 2015). This concept implies that human beings, objects and devices are the main elements in Internet of Things that play their roles in the environment of Internet. This is a new type of technology that connects networks of objects while retaining their online identity and enables access to objects and users to create business and remote control at anytime and anywhere (Al-Fuqaha et al., 2015). Therefore, the use of this technology in the advertising industry has led to the formation of a new generation called smart advertising.

1.2 Advertising

By definition, advertising is meant to convey an effective and efficient message from a source to the community (Kim & Jun, 2016), which is intended to communicate with the target audience with the aim of promoting a belief or introducing a product. Today, the business of advertising is a growing

science which is used by firms and organizations where organizations attempt to promote their businesses and achieve their goals through using brands, trademarks, advertising images, slogans, and, etc. (Shin & Lin, 2016). In fact, ads are used to disseminating thoughts, product sales, promoting social goals, informing, and many other things that aim at influencing the thinking, standards, and social and individual preferences of the audience among the sheer volume of ads (McEvoy, 2001). Meanwhile, advertisers through a variety of communicative and promotional ways try to keep old audiences and identify new products (Sever & Ling, 2013). Initially, advertising was performed by the promotional offices. With the growth of technology, this strategy was offered in more widespread ways in which the producers tried to advertise their services and products in a wider range of ways such as television broadcasting, printing in popular newspapers and magazines, and creating supportive programs like awarding prizes and gifts to increase the sale of their goods (Tiago & Veríssimo, 2014). Despite the remarkable advances in various areas, in today's world, the use of advertisements, leaflets and supportive programs are only few ways of attracting and influencing audiences (Martynova & Borisova, 2017). Consequently, manufacturers to compete and expand their own context of communication must apply new organized methods, since the use of organized advertising can provide good reflection to improve the brand in the peoples' minds (Bakhshizadeh et al., 2017). Although, advertisement plans involve in many aspects such as identifying target audiences (Patsioura et al., 2009), determining the purposes of communication (Voorveld, 2011), designing message (Mamdoohi, 2017), media selection, and finally the feedback collection, but they advertisements can be considered for the realization of business goals through the introduction of services and products (Buil et al., 2013), because the integrated design of an advertising program leads to a greater impact on public opinion.

1.3 Smart Advertising

Today the success of advertising depends on the consistency between its content and the users' needs. Since, technological advances in various areas are progressing day by day, it is obvious that advertising industry will benefit from the use of effective methods for communicating the message to the audience (Kim & Jun, 2016). In order to achieve this goal, "smart advertising" is applied which is considered as a new advertising as well as a key component of new technologies that can bring advertising closer to the interests and preferences of the audience with higher success rate and encourage them to buy the given products, so choosing an appropriate context for targeting users to provide a particular ad is one of the key issues (Shin & Lin, 2016). This targeting is based on the various information derived from the profile of individuals such as gender, interest, individual taste, geographical location, occupation, place of residence and the searches of the user on various websites to tailor the advertisements to the audience's preferences and in accordance with the conditions. The importance of this kind of advertising can be to provide smart advertising services based on the user's behavior in such a way that user information, identification and the most relevant ads are presented to the audience in this type of advertising, which in turn can lead to attracting more people. This paradigm is one of the most important new technologies in business, which aims to identify the interest of the audience in various

topics based on the feedback received from users and then try to present ads consistent with it. This approach refers to the process of providing information about products, offering services to customers, and encouraging them to buy and receive services (Bhargava et al., 2015). The importance of intelligent advertising can be observed in areas such as providing smart advertising services based on the geographic location, and user's needs and interests (Lee I. & Lee K., 2015). This targeting is formed based on different information obtained from the environment and individuals and allows users to access information based on time, location, type of device and according to the customer's request and displays advertisements to target customers (Li & Du, 2012). This scenario enables the advertiser to deliver products and services to targeted users more efficiently and effectively, and allows users to find their preferences and desires from a huge amount of data. Among the benefits of this technology are offering preplanned information tailored to the user's needs (Gubbi et al., 2013), which ultimately leads to a meaningful relationship between users' demands and the content of displayed information by smart objects (Sundmaeker, 2010). By programming the display data through devices connected to the Internet, this technology allows users to access personalized information and functional products (Lee, 2017). Attending to the customers' needs according to their personal tendencies, requires a thorough knowledge of the behavior and needs of the user. Smart devices acquire knowledge and awareness of customers' priorities and interests by recording events, the activity of users and their presence on a website or social network. Then through data analysis and examining results, getting information from the user's way of decision making and ultimately, they will display personalized ads because in today's world due to the competitiveness of commercial brands, advertising plays an important role in introducing products and services to customers and enthusiasts. Using innovative and new ideas in advertising can change customer awareness of the product, and encourage consumers to receive services and buy products. Smart ads try to identify the audience's interest in a variety of topics based on the feedback received from users and, accordingly, provide the right ads. According to this strategy, the content of the advertisement is personalized based on the user's interests and is presented at the right time and place in order to have greater effect on the target audience (Martins et al., 2018).

2. Literature Review on Advertising and Vision

In the recent years, physical objects with the ability to measure different environmental conditions have been identified in providing intelligent environmental advertising. So, street billboards are being more frequently used because they are considered to be the most widely used promotional tools. Billboards are then turned into intelligent objects with the ability to identify and understand the surroundings parameters, which have the ability to collect data using embedded environmental, thermal, visual, magnetic sensors. On the other side, the database system combines the analyzed data collected from the physical world with the resources and services to perform procedures by hardware and software in order to make decisions mainly called decision tree implementation. Consequently, a smart billboard will be formed which has the ability to receive environmental parameters and provide ads tailored to

the received data. According to McAvoy (2001), each member plays a certain role in advertising, which can lead to a better introduction of the product. In addition to emphasizing the use of all the elements, McAvoy also introduced the advertising slogan, brand name and logo as three key elements in advertising that could relate brand to the environment. According to the results, advertising slogans have an important place in supporting brand identity as well as a brand and logo design can be used as a direct sense to support promotional item. These results also showed that the use of elements in combination could lead to a stronger image of the brand in the minds of the audience (McEvoy, 2001). Considering the studies conducted in this area, we investigate researches in the field of environmental advertising. For example, Dunso et al. (1993) examined the factors which are influencing the brand's remembrance due to the impact of environmental advertising and revealed that advertisement design, frequent observing of advertising, paying attention to advertising space, and considering visual components and brands are among the most important factors that can influence advertised brand remembrance (Donthu et al., 1993). Meurs and Aristov (2009) investigated various approaches and aspects that have led to the establishment of environmental advertisements on the minds of people and concluded that the use of innovative ideas, design and appearance of advertising can play an important role in introducing brand and product while Acorn (2015) referred to environmental advertising as the most effective type of advertising that is conducted through the environment. More studies have also approved that environmental advertising which is conducted based on a desirable visual identity and creative and coherent design can have a positive and significant effect on sale (Bhargava & Donthu, 1999).

Advertisement using street billboards, which are known as the most recent growing approach to provide environmental advertising (Taylor et al., 2006), has also been studied in the literature where Belasco (1985) focused on the issues related to the effectiveness of billboards design. He found that factors such as the use of limited words, the clear introduction of a product, the use of simple context, creativity and innovation in the use of words, simple images and messages can attract more audiences and lead to a better product recognition. Hussein and Nizamani (2011) concluded that factors such as message, simplicity, color, place of billboard, creativity in the ad, the style of the text of the promotional content and the image displayed to introduce the product can be considered as influential elements in the attraction of the audience. The results of another study showed that factors such as legibility, color of the billboard, the use of white space and design in accordance with the location of the installed billboard play a significant role in the effectiveness of billboards (Balkaf et al., 2005). Advertising attributes such as media efficiency, local presence, perceptible response to the introduction of their services and the chance to be seen by others are in the main focus of companies' interests while capability of visibility and media efficiency are the most important determinants of decision making in relation to the continued use of billboards by these centers (Taylor et al., 2006). Conducting a questionnaire survey, filled out by population size of 332, revealed that awareness of advertising had no effect on audiences as well as creative environmental advertising and more color variation create a

higher level of awareness of advertisement (Chan & Cheng, 2012). Finally, in the field of Internet of Things for advertising, Lee and Du (2012) tried to identify mobile location for posting ads to target people in a given place and time I which mobile devices are considered to be a desirable media platform for purposeful posting of ads to marketers because of their smartness and accessibility. Mobile devices can send ads to people's geographic location.

Following the above mentioned, it can be concluded that environmental advertising studies pointed to some of the factors affecting billboard advertising that include creative advertising, wide appeal in attracting audience attention, advertising content, activity type, media efficiency and visibility. The main aim of this research work is to point on selecting messages on billboards according to parameters sensed by that. Therefore, by combining the mentioned factors, a new pattern is introduced and evaluated in the form of identifying the appropriate time and place for displaying the advertisement.

3. Designing Advertising Pattern

In this research work, a whole conceptual diagram focused on the existing relations between Criteria Review, named parameters, and Advertising Fields is proposed to indicate how the parameters influence on selecting advertising fields or messages. Parameters derived from the environment and traffic situation, while Advertising Field is defined as the subject can be shown and advertised on the billboard. Six parameters of air quality, traffic volume, speed, time, cars' license plates (or Plaque) and eventually weather condition have been considered. The field of advertising is also divided into nine categories of 1) jewelry, accessories and sanitary-cosmetic, 2) car repair stations and equipment, 3) home appliances, 4) concerts and movies, 5) stationery, 6) recreational centers, 7) food, 8) clothes and eventually, 9) public service advertising, listed in Figure 1.

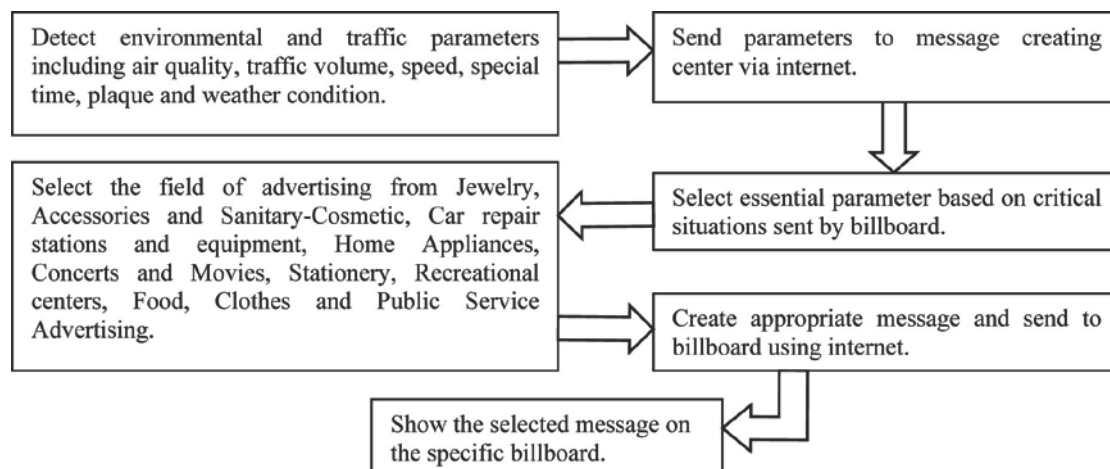


Figure 1. Parameters That Influence on Advertising Fields to Select Advertising Context

For each parameter, also known as criterion, specific types or states are defined and relevant decision should be made as the field of advertising. In other words, according to Figure 1, after identifying the

critical parameter from the billboard, an advertising context is selected. Critical parameter is selected according to the specified values of criterion comparing to the others. For example, if the weather is so hot or cold, weather condition will be considered as the main criterion, so the defined types of weather condition will be examined. In this case, displaying message is corresponding to weather condition. Since, it is assumed that the billboard is installed with the ability to embed multiple sensors to receive necessary environmental parameters, it can show the advertising context based on what it received from the environment. As another example, considering speed limit, the billboard aims to offer advertisements consistent with car speed, which in the event of considerable over-speeding rate, a safety message will be displayed. This pattern is also defined for the “car plaque”. Since car license plate number is assigned based on owner resident area in Iran, detection of the car plaque recognizes that the owner or driver is resident or guest, so ads context can be set for quests such as restaurants, hotels, or sightseeing areas. More details for speeding and car plaque are tabulated in left side of Table 1. In order to make a wide vision on relations between criteria and advertising fields, a preliminary questionnaire is used to collect data for the general selection of ads based on environmental and traffic parameters. The selection is based on the identification of the status of pre-defined parameters such as air quality, traffic, speed, time, car plaque, weather condition while advertising context is based on offering advertisements in different areas. After identifying the ads according to the existing criteria, a billboard message is then designed. Some examples of advertising contexts are also recommended according to all speed and car plaque parameters derived by billboard tabulated in Table 2.

Table 1. Advertising Context Displayed Based on Rate of Over Speeding and Guests’ Car Plaques

Criteria	State	Content	Criteria	State	Content
Speed	Authorized	Select other criterion	Car Plaque	Resident	Select other criterion
	Over-speeding	Display “Traffic Safety message”		Quest	Displaying tourist attractions, hotels and restaurants

Compound parameters’ analyzing is also available and can be made to improve the accuracy of selecting advertising field (context). Illustrating example can help to understand what is following made. As can be observed in Table 2, using the science of machine learning, the billboard recognizes the chapter and interprets the required environmental information. Then, analyzing the collected information is made to display the proper advertising field. Since the purpose of creating smart billboards is to attract the audience, after identifying the field of area, ads corresponding to the data received from the examined parameters are instantly displayed. This scenario is formed through expanding the range of ads tailored to the audiences or customers’ needs based on the environmental

conditions. In summary, the other fields can be suggested based on the parameters received from intelligent billboards.

Table 2. Analysis of the Displayed Messages of Time and Traffic Parameters

Time	Traffic condition	The content of displayed message by billboard
Winter	Light	Advertising winter cloths
Summer	Heavy	Advertising city sightseeing
Autumn	Average	Advertising heating home appliances
Spring	Light	Advertising restaurants, coffee shops, and recreation centers
	Average	Advertising cloths and cosmetics

4. Sampling and Data Gathering

Considering the studies carried out in this area, several options are considered as promotional context for each parameter of air quality, traffic volume, speed, time, weather condition, and car plaque. According to the initial questionnaire, consists of fifteen questions, which has been designed by five-score Likert scale (strongly agree, agree, no opinion, disagree, strongly disagree) is used for selecting advertising context in different areas and conditions. Consequently, a context for conducting a variety of analyses and studying the relationship between data in a conceptual way to test hypotheses is created. Table 3 describes the parameters and questions. Due to the high dispersion of the statistical population members, distributing online questionnaires to users has been performed and 107 filled out questionnaires have been collected and statistically analyzed.

Table 3. Parameters and Questions Related to Each Criterion

Parameter	Item Numbers	Parameter	Item Numbers	Parameter	Item Numbers
Air quality	1-2	Speed	4	Car plaque	10
Traffic	3	Time	5-9	Weather	11-15

At the beginning of the questionnaire, demographic questions on gender, age, education level, owning personal vehicles, the rate of public transportation usage, audience presence on public roads and the level of attention to billboards have been raised, and then specific questions of the research questionnaire in the form of the Likert scale have been designed. For each question, optional answers including I'm fully agree, agree, no comment, disagree, strongly disagree are suggested. The frequency of respondents, as demographic stats, based on variables has been examined summarized in Table 4. The validity of the questionnaire was examined and completed using experts and professionals' opinions while its reliability after gathering data was assessed by calculating Cronbach's alpha as 0.867, which indicates that this questionnaire correctly describes the responders' viewpoints.

Table 4. Demographic Stats Including Frequency Distribution of Respondents

Demographic Variable	Population groups portions (Percent)
Gender	Female (63), Male (37)
Age	Less than 20 years old (9), 20-30 (51), 31-40 (18), 41-50 (14), More than 50 (8)
Level of education	Diploma or less (9), Associate degree (2), Bachelor degree (50), Master degree Doctoral (6)
Owning car	Yes (55), No (45)
Rate of using public transportation	Very low (15), Low (22), Average (44), High (16), Very high (3)
Presence time in public areas (Hours a day)	Less than 2 (58), 2-3 (28), 3-4 (5), More than 4 (9)
Paying attention to the billboards	Very low (18), Low (20), Average (44), High (10), very high (8)

5. Pattern Validation

After gathering the necessary data derived from analyzing the filled out questionnaires, on what responders think about the proposed pattern two hypothesis testing procedure are taken to check the validity of the pattern and also the homogeneity of responders' viewpoints. The well-known T student test analysis is utilized to check the relations between parameters and advertising messages as well as single factor analysis of variance is also used to check the homogeneity of responders, all are discussed more in detail as follow.

5.1 Hypothesis Testing on Relations between Parameters and Billboard Messages

To evaluate the status of each variable, the single sample T test has been utilized. Regarding the use of five-scale Likert, the score of 3 (average) is considered as the based average (Babaei & Mahmoudabadi, 2018). In the measurement of the research variables, sub-scales are used as separate markers in order to identify the relationship with advertising metrics. Therefore, considering the conceptual framework of research and the relationships between identified variables, the following hypotheses are developed and presented as samples while all conclusion remarks are outlined. It should be mentioned that except for demographic questions, a complete view of the questionnaire is shown in Table 5 where all questions are ticked by audiences using Likert scale.

Hypothesis 1: There is a positive and significant relationship between the "Air quality" and public service advertising and foods.

Hypothesis 2: There is a positive and significant relationship between the "Traffic condition" and repair stations and auto spare parts.

Hypothesis 3: There is a positive and significant relationship between the "Speed" and the safety messages shown on the billboards.

Hypothesis 4: There is a positive and significant relationship between the “Special time” and jewelry, accessory, cosmetics, health products, home appliances, concerts and films, stationery, recreation centers, food and clothing.

Hypothesis 5: There is a positive and significant relationship between “Weather condition” and health products, home appliances, food and clothing.

Following the above hypothesis, by calculating the T-stat for each item of questionnaire, the statistical analysis of advertising pattern validation is presented in accordance with the environmental and traffic parameters. For example for the first hypothesis, there is:

H0: $\mu=3$; There isn’t a positive and significant relationship between advertising on encouraging the use of public transportation and “polluted” and “too much polluted” air.

H1: $\mu>3$; There is a positive and significant relationship between advertising on encouraging the use of public transportation and “polluted” and “too much polluted”.

After determining the initial assumption, data analysis was conducted to confirm the relationship between all parameters and message fields shown on the billboards. For the first question, the obtained value is 3.996, followed by variance calculated as 0.486, standard deviation is also equal to 0.697. The value of the T-stat is calculated to 18.238 by equation (1). Then, the T-stat is now obtained and should be compared to the confidence level of 95% ($\alpha = 0.05$). In this item, T-stat is greater than the T extracted from the statistical t-student table. Therefore, the null hypothesis is rejected means that “There is a positive and significant relationship between advertising on encouraging the use of public transportation and ‘polluted’ and ‘too much polluted’ air”.

$$T = \frac{\bar{X} - \mu}{\frac{\sigma}{\sqrt{n}}} = \frac{3.996 - 3}{\frac{0.697}{\sqrt{107}}} = 18.238 \quad (1)$$

The above steps are done for each item for the data collected from the questionnaires by calculating the mean, standard deviation, t-stats and all are tabulated in Table 5.

Then, the t-value obtained for each questionnaire item is now compared to the one derived from t-student distribution at the specified confidence level set as 95% ($\alpha = 0.05$) and equal to 1.662. Table 6 depicts the results of comparing t-stat on Table 5 to 1.662 and outcomes P-values for all items. As can be observed, assumptions are accepted in all sections of the advertising conceptual model. After the confirmation of pattern advertising, the process of providing smart advertising of the streets using the “Internet of Things” can be proposed as what depicted in Figure 2.

Table 5. Stats Calculated for All Items of the Designed Questionnaire

Parameter	Item	Mean	S-D	T-Stat
Air quality	Advertising to encourage the use of public transport on “polluted” and “too much polluted” air.	4.235	0.697	18.238
	Advertising to use dairy products in the condition of air pollution with a “dangerous” and “toxic” quality.	4.141	0.844	13.917
Traffic	Advertising on authorized car repair stations is appropriate when traffic volume is heavy.	4.140	0.926	12.736
Speed	Displaying safety messages is recommended when the rate of vehicle speeding is considerable.	4.330	0.777	17.618
Time	Public service advertising is appropriate at night-time.	4.198	0.832	14.810
	Advertising on clothes, cosmetics, restaurants and coffee shops in certain days of the spring is recommended.	3.858	1.081	8.170
	Promotion of recreation centers, travel tours, shops and exhibitions in certain days of summer is suitable.	4.122	0.982	11.761
	Promotion of book and stationery stores is appropriate in beginning days of autumn (educational semester).	4.173	0.959	12.464
	Promotion of winter clothing stores and heating supplies are appropriate in cold days of winter.	4.047	0.959	11.230
Car Plaque	Adverting on hotels, restaurants, displaying the electronic map of the city and tourist attractions is recommended when the car’s plaque are considerably known as guests.	4.209	0.873	14.158
Weather Condition	When it is snowy, promoting heating supplies is appropriate.	4.283	0.777	16.984
	Promoting hot drinks is suitable for rainy weather.	4.285	0.768	17.142
	Advertising on sunglasses is appropriate on sunny days.	4.169	0.761	15.734
	Dairy advertising is suitable for dusty air.	4.141	0.809	14.510
	Promoting car wheel chain is appropriate in icy weather.	4.424	0.616	23.739

5.2 Hypothesis Testing on Homogeneity of Responders’ Viewpoints

The next step is to check the homogeneity of responders’ categories those have filled out the questionnaires to insure that if there are statistically significant differences between the means of groups or not. In theory, if the means of groups are statistically the same, it is concluded that there is a consistent viewpoint between groups’ viewpoint. The well-known statistical technique of single analyze of variance, ANOVA, has been utilized to test the existing differences between the means of groups. For example in age groups, responders are divided into five age groups including “less than 20, 20-30,

30-40, 40-50, and more than 51 years old” shown in Table 7, F-stat, which is calculated by dividing the mean of between groups variations by within groups variations, revealed that there is no significant difference between age-groups of who filled out the questionnaires. More statistical test have been made and corresponding stats have been calculated and tabulated in Table 8 where the results approved that there is no significant difference between groups over the categories made or existed over the responders. Therefore, it is concluded that all responders come from a homogenous population and they have the same opinion on approving the field of advertising based on environmental and traffic parameters sent by Internet of Things methodology.

Table 6. Conclusion Remarks on Relations between Parameters and Advertising Contexts

Parameter	Advertising Context	P-Value	Conclusion remark
Air quality	Public transportation	2.66E-5	There is a positive and significant relationship to encourage the use of public transport on “polluted” and “too much polluted” air.
	Dairy products	4.02E-4	There is a positive and significant relationship between advertising on the use of dairy products on “dangerous” and “toxic” air.
Traffic	Authorized repair centers	1.09E-4	There is a positive and significant relationship between advertisements for authorized car repair centers and heavy traffic.
Speed	Safety messages	3.05E-5	There is a positive and significant relationship between the advertising of safety messages and the unauthorized speed of vehicle.
Time	Public transport	6.05E-5	Public service advertising is recommended at night time.
	Clothing, cosmetics, and coffee shops	7.33E-3	There is a positive and significant relationship between clothing, cosmetics, restaurants, coffee shops ads and certain days of spring.
	Recreational centers, tours, shops	1.50E-4	There is a positive and significant correlation between the promotion of recreational centers, travel tours, stores, exhibitions and special days.
	Book and stationery suppliers	5.57E-4	There is a positive and significant relationship between advertising store that supply books, stationery, and special days of fall.
	Winter cloth stores and heat supplies	1.79E-4	There is a positive and significant relationship between the promotion of winter clothes, heating

Parameter	Advertising Context	P-Value	Conclusion remark
			supplies and cold days.
Car Plaque	Hotels and restaurants, electronic maps of the city and tourist attractions	7.17E-5	There is a positive and significant relationship between the promotion of hotels and restaurants, the display of the electronic map of the city, tourist attractions and cars with non-native plaques.
Weather	Heat supplies	3.52E-5	There is a positive and significant relationship between advertising on heating appliances and snowy weather.
	Hot drinks	2.16E-4	There is a positive and significant relationship between the promotion of hot drinks and rainy weather.
	Sunglasses and sunscreens	2.79E-4	There is a positive and significant relationship between the promotion of sunglasses, sunscreens and sunny weather.
	Dairy products	3.55E-4	There is a positive and significant relationship between dairy food advertising and dusty air.
	Wheel chain	9.25E-6	There is a positive and significant relationship between promoting car wheel chain and icy days.

Table 7. Results of ANOVA on Age Groups on Paying Attention on Billboards

Age group	Count	Sum	Average	Variance	Source of Variation	Between	Within
< 20 years	9	25	2.777	2.694	Sum of variation	3.564	125.426
20-30	55	153	2.781	1.099	Degree of freedom	4	100
31-40	19	46	2.421	0.923	Mean	0.891	1.254
41-50	14	39	2.785	1.719	F Stat	0.710	
> 51	8	18	2.25	0.785	F Critical	2.462	
Notification		F Stat < F Critical means that there is no significant difference between age groups on paying attention to the street advertising billboards.					

6. Conclusion and Recommendations

Since smart advertising is swiftly growing over the world, a conceptual pattern has been proposed in this research work to suggest billboard messages according to the environmental parameters sensed by billboards. The main concept behind the proposed pattern is to sense the environmental and traffic measures by smart billboard, send to a decision center to make an appropriate message and eventually show that on billboards. To gain better performances, all procedures of sensing parameters, sending

data, making decision on what advertising types should be appeared, and eventually selecting the billboard are performed in the bases if Internet of Thing. The proposed pattern has been discussed in detail as well as a research made questionnaire has also been developed to evaluate that. Analyzing the collected viewpoints of a sample size (107 persons) revealed that there is a positive and significant relationship between environmental and traffic parameters and message contexts displayed on the billboard.

As a result, the billboard will have the capability to display ads in the fields associated to each parameter after identifying them from the environment. In this process, the way of identifying the parameters based on the sensors embedded on billboard and the way ads are displayed based on the identified criteria is conducted instantaneous. The general concept of the “Internet of Things” and its application in the advertising industry were examined.

The future researches are suggested to study more generalization of this research mainly performing similar research using urban elements, identifying more environmental parameters and examining different states, evaluating the impact of an advertising project among audiences in order to compare with other advertising media and eventually investigating the likelihood of accepting the provided ad in the community to evaluate the success rate of the project.

Table 8. ANOVA Results on Groups Attributes to Pay Attention on Billboards and Safety Messages

Attribute	Groups	F-Stat	F Critical	P-Value	Conclusion Remark
Attention to billboards	Gender (Male, Female)	0.007	3.932	0.935	There is no a significant difference between gender, age groups, and owning cars on the attention to street billboards.
	Age (five groups)	0.710	2.462	0.586	
	Owning cars (Yes, No)	0.644	3.931	0.424	
Attention to safety messages	Owning cars (Yes, No)	0.160	3.935	0.689	There is no a significant difference between owning car states and using public transport on attention to safety messages.
	Public transportation	2.327	2.461	0.061	

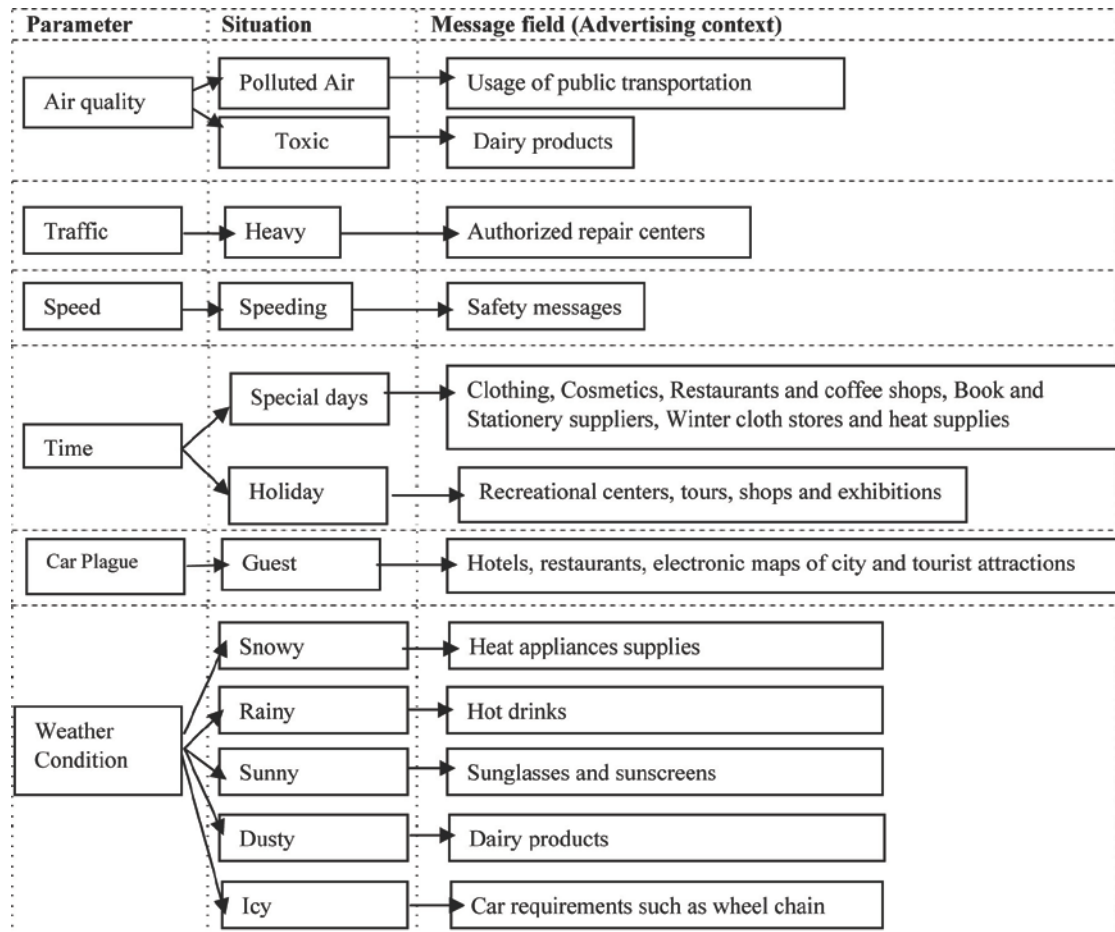


Figure 2. Smart Advertisement Messages Approved by Responders' Viewpoints

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