

# Determining Ways of using Digital Out of Home Signage to Advertise on Static Traffic Signals

Wesam M. Ayada

Faculty of Applied Arts- Advertising Dept.-Damietta University –Egypt.  
Emirates Collage of Technology- Mass communication and Public relation-UAE

**Abstract**-Digital signage is a name given to any number of methods used to display multimedia content in public venues. It is a technology and a communications medium that had been used as an advertising tool for carrying a commercial, informational, experimental and behavioral content message; it's a form of out of home advertising containing a message that can be digitally changed through a connected playback device (such as a computer, VCR or DVD player) connected to the screen. Most of the digital signage are targeting "captive" (or waiting) audience: on different places indoor as on malls, organizations, airports, retails, trade shows, cinemas, hotel, vehicles...etc., or outdoor by targeting passengers on the street. The approach of this paper is to determine a way of using digital signage as an advertising medium displaying messages for fastness passing drivers while waiting on traffic signals providing them with entertainment and increasing grabbing attention of target audience for products or services. The research assumes that this can be applicable on crowded cities that have a fixed interval time for traffic signal to open and close; the signage will be connected to the signal circle for starting and ending showing messages and with an additional function of directing cars drivers to move and stop. Also the signage will carry TV advertisements with audio that can be heard through a specific radio wave that can be adjusted on the car radio. A case study will be applied on Abu Dhabi city to show the ability to apply this on it.

**Keywords:** Digital out of home signage, attention, human behavior

## 1. INTRODUCTION

Digital signage had been introduced to the market of advertising as one of out of home advertising medium that can display a number of controlled messages to audience on-the-move in different places. With a video, animation, data, photo combined with audio or not shown concurrently on multiple zones, or regions, on any given screen.

Digital signage had been used indoor for static audience through screens displaying instructions or information's, at many different places as retails, shopping malls, banks. For example, at banks we can see the screen displaying advertising messages for the bank products and services as a part of the screen that inform people with their ticket no. while they are waiting on a bank to finish their papers. Collages use them to inform their students with different instructions or information's beginning from the semester schedule to any other information related to the student.

Digital signage display can be LCDS or LEDS display, with a technology differ from the normal screen of TVs. Controlled through a network operation center and a content

management server (for software control and monitoring) are typically involved.

Distributing for the message can be through different methods depending on the place where we can find the digital signage and the no. of them related to each other. Distribution for the information could be through an internet service providers (ISPs), whose wires and signals are delivered to a server and then relayed further by wires to a user, or through a wireless distribution or even through satellites. In this paper i try to exam a way of using digital out of home signage to display advertising messages, in addition to different informational messages may be related to the temperature or traffic situation to be displayed for fastness passing drivers waiting on a traffic signal so as to use these places as a POT. Used digital signage will face them while waiting to pass the traffic signal that can last for a long time on rush hours. Actually most of out of home digital signage display only a silent messages to street passengers, even if the this video is combined with audio on other medium. In this paper I assume that videos combined with audio can be displayed and heard through the car radio by buying time of broadcasting the audio on famous channels that can display it on parallel with the image. As the digital signage will be tied to the traffic signal control the displayed images will stop s long the traffic is moving, displayed only on the static mode of the signal.

## 2. BACKGROUND

### 2.1 Digital signage

Digital signage is revolutionizing the media and information industries by allowing the central and rapid update of content and its immediate delivery to audiences in specific locations. It is defined as "remotely managed digital display, typically tied in with sales, marketing and advertising" [17]. Consisted of a networked, audiovisual information system that allows remote controlling contents – either program-driven or manually – but in any case from a centralized system [7].

Digital signage can deliver different forms of content commercial, informational, experiential, and behavioral messages and creating content for them doesn't differ from creating content to any other screen. And this content can be one of three types, or a combination of any of them, a) a real time content which means that the displayed information is immediately happening as breaking news or sporting events, b) near-real-time where this kind of data has to be current within a few minutes but it need time to be transferred from the original source to various local installations, such as stock

tickers or gambling odds, c) the last type is non-real-time content where the data is stored and available for use long after it has been created, such as advertisements [17].

A study conducted by Info Trends found that digital signage displays have 47.7% effectiveness on brand awareness, increase the average purchase amount by 29.5%, create a 31.8% upswing in overall sales volumes, generate a 32.8% growth in repeat buyers and generate 32.8% more in-store traffic [6].

It offers advertisers brand new options, the flexibility to run shorter and part day campaigns that refine focus to specific commuter audiences, in addition to the opportunity to push dynamically updated copy [9]. Digital signage can adapt to time and location, such features are called contextual signage where the shown messages are based on the ability of the system to display information on the basis of contextual factors such as time, location, demographics, consumer preferences, etc.

### 2.2 Characteristic functions of a digital signage system

There are four basic types of locations where digital signage networks can be successfully applied; first, is point of sale (POS) where consumers are encounter close to the product or service for sale as retails, convenience stores, and shops with consumer goods, and within POS network category there are at least three subcategories to be considered a) brand -owned network , b)retailer- controlled network, c)signage in the public areas of shopping malls [13]. On those places 75% of purchase decisions are taken, so having the right message will convince consumers to take the right decision [4].

Second is point of wait (POW) where we can find consumers waiting for finishing a service of buying a product , they are called dwell time viewers, the primary goals of digital signage at the POW are: (1) communicating key messages geared towards brands and products related to the service provider, (2) increasing customers' satisfaction, thereby influencing their perception regarding the actual waiting time, and (3) providing interesting, relevant content in various ways [4]. One of the most advantages for using digital signage on POW that the consumers are more deeply involved with the content shown in addition to consumers of POW are more receptive and have sufficient time exposure to allow for longer messages and sufficient repetition [13].

The third alternative is the point of transit (POT) they are called the live poster of industry, where the audience (in transit) are on-the-go viewing. This kind of signage is typically found at airports, metro, train or bus stations, and store windows, (and here we can add consumers waiting at the traffic signal to pass). The most important point here that passenger's time is very short and their attention has to be caught within a very short time through a well evaluated content [13].

Last is Points of Gathering (i.e. student unions, stadiums, hotels, hospitality venues, museums, office and manufacturing workplaces,) [1]

### 2.3 Digital signage technology

Signs are becoming ubiquitous, in part because LCD displays have decreased in cost, and display sizes have also increased. Applied Material's latest TFT-LCD deposition machines can

work with glass that's 11 feet on a side, or about as large as a garage door [18].

A dynamic communications signage provides the ability to rapidly develop and present a message, preferably with minimal efforts, in addition to recency which means the capacity of a medium to deliver a message in close time proximity to a future action .A typical signage network of dynamic media includes central control (Content Management) software, connectivity between the central control point and media players that drive media presentation on devises located at a specific location [1].

Typically, content spots are integrated into a play loop of 1 minute or more in duration, coinciding with the length of time that a person would be in the viewing proximity of the display. Play-loops and content are configured to optimally reach viewers according to traffic pace, dwell time and viewer demographic

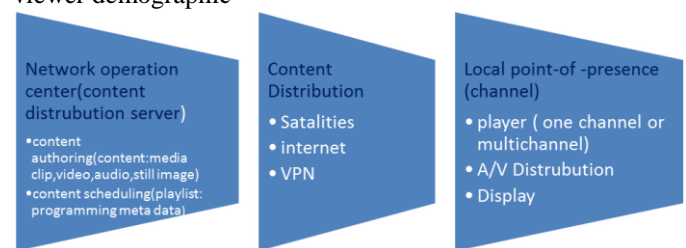


Figure no (1) Show a typical signage network

### 2.4 Effect of Ambient light shining, humidity, and high temperature on digital signage

A problem occurs on the early versions of digital signage related to high ambient light that has an effect on viewing digital signage specially those found outdoor. Direct light from sun during day does impacts the light produced by the display itself resulting less contrast and washed-out images and colors so the images become very difficult to read. Beside that the viewing angle becomes reduced due to the lower contrast level. Other types of lights produced from the sun as ultraviolet (UV) that causes discoloration over time, in the form of yellowing or graying of the LCD surface and the image being produced. Also Infrared (IR) produced from sunlight causes internal heat buildup, tiger-stripe or Mura type dark and grey bands on the image being displayed [21]. A patented CCFL (cold-compact fluorescent- light) technology used to produce a high brightness screen with the ability to output up to three times as much light as a standard digital sign provided by equipped with a wider viewing angle that can range to 180degree, this technology is safe for the environment as offering an LED backlit light source, which contains no mercury [21].

A due to the revolution on technology and in order to combine with consumers needs new types of digital out of home signage technologies had been introduced. They are designed for 24/7 continuous operation, with an auto brightness sensor, where screen brightness is automatically adjusted by its surrounding illumination level during the day. The brightness level will automatically increase for better visibility. During the night, the brightness will automatically decrease the brightness to save energy, by using the Smart energy saving function, helping provide lower energy

consumption compared to other conventional LED backlight displays. Meeting with environmental regulations such as EPA and ERP, while, excluding the use of harmful materials (ROHS) [14].

### 1. Consumer behavior towards digital signage

Consumer behavior entails all consumer activities associated with the purchase, use, and disposal of goods and services, including the consumer's emotional, mental, and behavioral responses that proceed, determine, or follow these activities [8]. Digital signage like any other types of out of home boards aim to affect the consumer behavior in order to take an action towards a service or a product. Consumers' responses to these stimuli may differ depending on whether they are purchasing, using, or disposing of a single product or service.

#### 3.1 Consumer attention to digital signage

Attention is the mechanism or a set of mechanism for selecting representation. It is the degree to which consumers focus on specific stimuli within their range of exposure [19]. Attention occurs when the person allocates processing capacity to the stimulus [10]. Thus (Svetlana Bialkova, 2010) defined attention as the psychological and neural mechanisms that mediate perceptual selectivity for (cognitive) action [20]. In the context of driven attention to digital signage it is not a matter of bottom-up effects (e.g., screen size, animated advertisements or sound), but rather of providing relevant content [4]. The context of the advertisements shown on the digital signage will affect the attention of the consumers by having a novel design for the displayed messages, attractive layout and preventing the overload of information due to the over load of functionalities will increase the effectiveness of digital signage on consumer attention.

The exposure for a message from an out of home signage will cost the consumer to behave either in a negative or a positive way towards what he see on the signage as a part of his attention will be spent for this task. Thus, each advertisement displayed in front of you causes some 'attention costs' to the consumer. So if the advertisement conveys some useful information for him and thus cause a certain benefit and at the same time these benefits are higher than the costs, then the consumer will be satisfied for what he have spent. But if, the benefits are less than the costs, consumer may behave in a negative way or even angry about the advertisement [12].

#### 3.2 Measuring the Impact of using Digital signage on consumer attention

Digital signage has been reported to be an effective form of that can provide improvements in customer perceptions of service settings [3]. Where perception of environment can be considered as a "package" of interacting components [11]. Therefore, the atmosphere or back-ground may be manipulated to "prime" people's perceptions and thus change behavior in such a manner that they may or may not be aware of the presence of the stimulus [3]. Puccinelli finds that people who are in a good mood have a better perception of products and are willing to spend more money [15] and a generalization study by Burke reveals that in-store digital

signage increases customer traffic and sales [2]. To make digital signage more effective as an information interface, the displayed content should be informative, dynamic and attractive [16].

Advertiser's uses "anonymous video analytics" equipped with USB cameras and facial recognition software offering "proof of impression in order to measure the impact of advertisements displayed using a digital signage. This can take place with at home signage that can be found on POS through measuring the number of viewers, viewing duration and audience demographics, this system can track whether consumers are paying attention to the display, just glancing or ignoring it then correlating this data to actual purchases by cross-checking sales receipts [5]. These systems help advertisers gauge content effectiveness and target consumers by adapting advertising and messaging in real-time, based on the demographic composition of the audience.

Another quantitative study done by Robert Ravnik and Franc Solina where a real-time audience measurement system based on computer vision methods was developed for detecting and tracking persons' faces from video captured by a digital Sony Vio VPCL135FX/B computer display enhanced with a Logitech WebCam Pro 9000 camera that accompanies the digital signage screen for testing the characteristics and attention responses of 1294 people. A measurement metrics for demographic audience where determined including four main points a) dwell time which represents the sum of all time intervals when an observer was present in the same room or area as the display, b) in-view time which represents the duration of all time intervals when an observer was facing the display screen, c) attention time which is a part of the in-view time when an observer is actually looking at the display and last d) the gender and age group which are demographic characteristics of each individual customer [16].

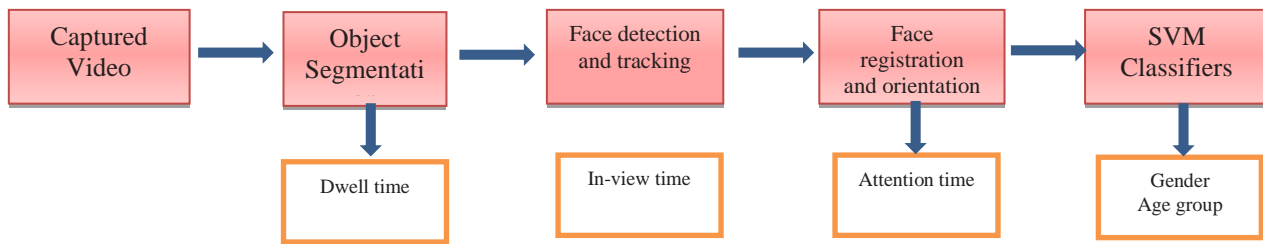


Figure no (2) show Scheme of computer vision enhanced digital in home signage system ([16])

But for out of home digital signage the way is different, a comparative case study of Huang et al. (2008) reveals that paying attention to public displays is a complex process, which depends on several criteria such as positioning of the display, display size, content format and content dynamics. Therefore, to maximize the attention to digital signage, these parameters should be considered already during the design phase of the digital signage system [16]. To measure the attention of consumers to this signage Jorg Muller and Antonio Krüger proposed a method to integrate auctions for tradable attention certificates with auctions for advertising slots on digital signage. This method allows implementing tradable certificates with relatively low transaction costs. It enables to define a maximum amount of attention that is consumed at a certain location at a certain time. In addition to staying within these limits with minimum costs for advertisers [12].

#### 4. MY CONTRIBUTION

A designed experiment that can be applicable on Abu Dhabi city on UAE will take place to show the criteria of applying out of home digital signage for fastness passengers on traffic signals.

##### 4.1 Determined place

Abu Dhabi city is the capital of UAE, with a population of 2.5 million; Abu Dhabi is a crowded city as most of the people living their own cars. The city is provided by a transportation network (buses and taxi). The climax is very hot as the temperature can reach 50c on day light, with high range of humidity especially on summer that this climax last for more than 6 month a year, which makes walking

in the street very difficult. One of the most important notes about the city streets is that it has been designed on main high way roads that have about 20 cross section streets controlled with traffic signals. The interval time for a fastness person waiting on a traffic signal to cross the street is 90 seconds as every signal of the other three cross section takes 30 seconds for each. On rush hours fastness can wait for more than three min to cross the road.

##### 4.2 The aim of the designed traffic signal digital signage

- Exploiting of this time to show advertisements on a facing digital signage to fastness drivers or riders on transportation vehicles will add entertainment for this boring time of waiting.
- Increasing number of people exposed to the advertising message as they will be facing the signage which is connected to the signal data and this will make it differ than others digital signage found nearby on a building or standing aside the street, as the driver will not be worry to have a look to see if the signal is opened or not which means that all his attention will be connected to the signage.
- Displaying TV advertisements and videos combined with audio which isn't applied to be displayed on digital out of home signage found on streets now.

##### 4.3 Identifying the roles, strategies, and configuration requirements

**Roles:** Displaying different type of advertisements for fastness passengers on traffic signals, not only still images and animated ones but also displaying TV advertisements and Videos combined with audio.

**Strategies:** Signage will be connected to the traffic signal to display different types of advertisements and will stop displaying any images during passing the signal and its color will be changed to the green one (so it will be a part of the signal at that time).

When the interval time for passing finish the signage will show red color to stop the cars from moving as the signal and start to display its advertising messages.

A message with the radio channel frequency will be displayed, so passengers can hear audio of the displayed advertisements on their car radio.

Different radio channels can be used to display the audio accompanied with the advertisements according to coordination of broadcasting.

Digital signages installed related to traffic signal with same coincidence of opening and closing can be connected to the same radio channel synchronization.

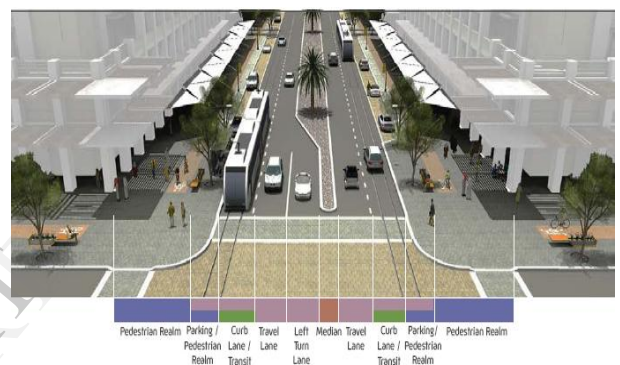
Signage will display advertisements, messages and information only for eighty four seconds and the other six seconds will be used dividedly for a) to inform fastness with the radio channel frequency b) to inform drivers to stand by for moving as the signage will stop displaying any content before the opening of the signal.

#### *Configuration requirements:*

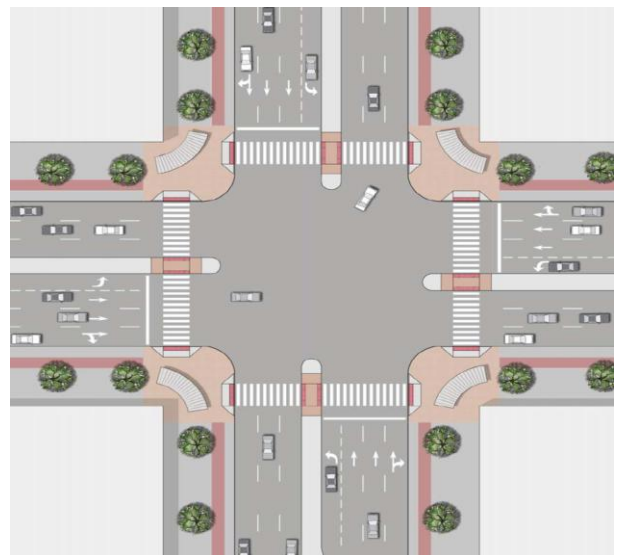
Digital out of home signage on traffic signal can be applied on traffic signals where the left side and right side of the signal close and open at the same time, as there are some signals the left side and the right side does not go at the same time

#### *Implementing a digital signage system on traffic signals*

a) Different places with an observation of high traffic can be a good place for installing the digital signage. Due to the urban design of the city and its plan for 2030, streets are designed for nearly standard three car lanes with a width of 3.3m each ( now it is 3m) with an end point before the signal for four lanes. signals are designed and fixed on the raised median of the perpendicular street 9m off the head of the street on a height of 5.5m. Vehicles stop 1.5m (the standard is vehicle stop lines should be placed 2-3 m before the crosswalk) away from the pedestrian crossing with a width of 2m. which lay 1m away from the street head which means that the distance from the vehicles to the signal almost 13m. signals should be seen 50 m away from cars with normal speed of 80 km/h.No signs or advertising structures shall be placed within 10 m of junctions.<sup>1</sup>



<sup>1</sup> Abu Dhabi urban street design manual , vision2030, Abu Dhabi urban planning council, 2013



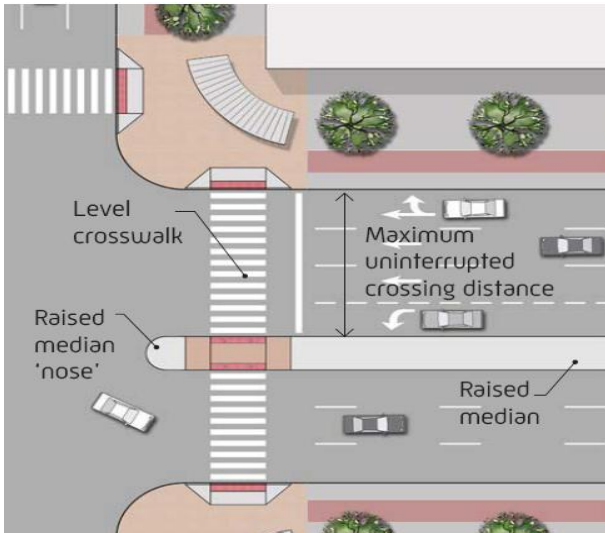


Figure no (3) show the streets design in Abu Dhabi

b) To determine the best point to place a digital signage on the signal, a photo session took place in the streets from different lane position in order to determine (visual zone, blind zone, and background zone) to fastness drivers

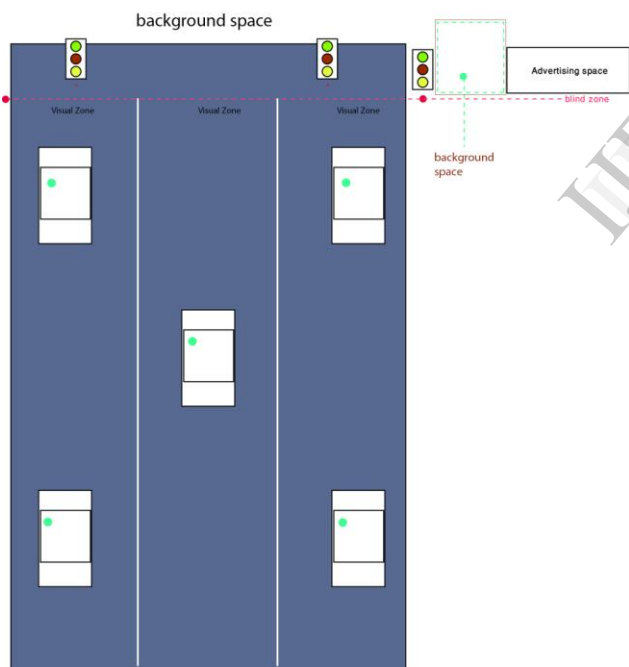


Figure (4) show the different zones seen by fastness drivers

Hypothesis 1: locating digital signage between the traffic signs found on the top

Locating a signage on the standoff signal, this will be the best place for full vision for drivers, with no visual barriers, and a visual area of 90 ° for middle lanes and a range of 120° for left and right lanes. But geometrically the pole holding the traffic signal is designed and installed to hold the specific weight of the sign and not designed to hold high weight, so to

install a digital signage on this place the traffic pole should be replaced with another that hold the weight of a typical signage. This will be difficult to be done due to the urban design of the city streets that cannot be changed. Although a traffic pole with the same shape but different materials of installation and lifting loads will be the best solution



Hypothesis 2: locating digital signage with a gate design opposing the fastness cars.

Positive point had been determined to place the signage in the traffic signal, by locating a head in front of the fastness drivers, on a gate of steel holder that can hold the weight of the signage.

The gate will be positioned on the head of the crossing street, quiet after the pedestrians walking area to cross the street, away from cars on first row about 28m.

*Height of installation:* A gate will be installed on a height of 5.5m, with the dimensions of 9m width x 1.5 m height x 0.70 m depth. The angle of a display to the walking direction: will be perpendicular with a 90 degree with the street.

*Displays size:* A digital signage of 46 inch (a typical screen is 60 cm height with 100 cm width) with a dimension of 120 cm height x 3 meters width can be installed with specifications of operating temperature not less than 50°C.



## RESULTS

- 1- The digital out of home signage found facing a fastness driver on a signal and connected to the signal data of opening and closing will insure that fastness driver are having a look on exposing to the advertisement messages facing them.
- 2- Entertainment for fastness on their vehicles as watching advertisement messages especially on rush hours where they can wait for more interval times.
- 3- Using connected digital signage to traffic signal will be safe as no displaying images will take place while the vehicles are moving.
- 4- TV advertisements or videos with audio will be displayed, as the audio can be heard through a paid time on radio channel its frequency will be displayed on the beginning of the message, so customers can adjust the radio channel to hear the audio.
- 5- A data collection (from the traffic police and through street cameras monitoring the traffic) about the passerby on the current place can take place to give more information about the targeted consumers, the gathered data will allow to adapts the display content to the passersby characteristics.

## DISCUSSION

A new type of advertisements as TV advertisements and videos combined with audio sound can be easily displayed, so during displaying the image, the audio will be displayed synchronized through radio channels where the interval time will be bought. Synchronizing audio with displayed image will not be hard so as the signage is connected to the signal this means that the time of these types of videos to be displayed will be controlled with no delay which will give the opportunity to choose the coincidence time. A notification message will be displayed on the beginning of the loop with the radio channel frequency wave no. to let the consumers adjust them before the audio is displayed, also video with audio can be controlled to be delayed for a wait to give the opportunity for the driver to adjust the radio channel.

New cars containing displaying monitors facing the drivers can display different channels with audio but only when the car is in a static situation and image displaying stops when the car is in a dynamic move, so for the safety of the drivers the digital signage on the traffic signal will stop displaying any images during the opened signals, displaying only a green color warning the drivers to keep moving.

## REFERENCES

- [1] Bunn, L. (2010). *Cmpus Dynamic Signage Networks, Communications Value and New Revenues*. NEC Display Solutions of America, Inc.
- [2] Burke, R. (2009). Behavioral effects of digital signage. *Journal of Advertisers*, 49, 180-185.
- [3] Charles Dennis a, Andrew New Manb, J.Josko Brusa, Richard Michon d, len Tiu Wright. (2010). The mediating effect of perception and emotion: Digital signage in mall atmospherics. *Journa lof Retailing and Consumer Services*, 205-215.
- [4] Christine Bauer, Paul Dohmen, Chrisine Strauss. (2011). Interactive Digital Signage – an Innovative Service and its Future Strategies. *International Conference on Emerging Intelligent Data and Web Technologies* (pp. 137-142). IEEE computer society.
- [5] Computing Technologies for Digital Signage (2009). U.S: Intel Product Technologies.
- [6] Digital Signage Market Rapidly Expands. (2006). Retrieved May 2014, from Digital Signage Resource.: (Digital Signage Resource. (2006, 14 Mar <http://www.digitalsignageresource.com/digital-signage-articles/digital-signage-market-rapidly-expands.asp>)
- [7] F. Goldberg. (2007). "Digital Signage in Deutschland: Benchmark-Studie werbefinanzierter Digitaler Out-of-Home Netzwerke. ", Smart TV Networks, Munich.
- [8] Frank R. Kardes, Thomas. W. Cline , Maria L. Cronley. (2010). *Consumer Behavior: Science and Practice*. South-Western, Cengage Learning.
- [9] Goldmedia. (2009). Digital signage becomes ubiquitous. Retrieved may 12, 2014, from <http://www.goldmedia.com/en/news/archives/info/article/digital-signagebecomes-ubiquitous.html>
- [10] Guido.G. (2001). The salience of marketing stimuli: An incongruity-salience hypothesis on consumer awareness. KLUWER Academic Publishers.
- [11] Jacoby, J. (2002). Stimulus-organism-responsere considered: an evolutionary step in modelling (consumer) behaviour. *Journal of Consumer Psychology* 12 (1), 51-57.
- [12] Jörg Müller, Antonio Kruger. (2007). Competing for your Attention: Negative Externalities in Digital Signage Advertising. *Designing and Evaluating Ambient Information Systems* (pp. 9-12). Toronto, Ontario, Canada: The 5th International Conference on Pervasive Computing.
- [13] Kelsen, K. (2010). *Unleashing the Power of Digital Signage: Content Strategies for the 5th Screen*. Amsterdam: focal press, Elsevier.
- [14] LG. (2013). *Monitor Signage: Engage your customers through visual display*. LG.
- [15] Puccinelli, N. (2006). Putting your best face forward : the impact of customer mood on sales persone valuation. *Journal of Consumer Psychology* 16 (2), 156-162.
- [16] Robert Ravnik, Frank. solina. (2013). Audience Measurement of Digital Signage: Quantitative Study in Real-World Environment Using Computer Vision. *Interacting with Computers Vol. 25 No. 3.*, 218-228.
- [17] schaeffler, j. (2008). Digital Signage: software ,networks, advertising and displays: A primer for understsnding the busines. focal press.
- [18] Schilit, Roy Want, Bill N. ( May 2012). Interactive Digital Signage. IEEE Computer Society.
- [19] Solomon, M., Bamossy, G., Askegaard S. (2002). Consumer behaviour: A European perspective. Pearson Education Ltd.
- [20] Svetlana Bialkova, Hans. Van Trijip. (2010). What determines consumer attention to nutrition labels? *Elsevier Ltd*, 1042-1051.
- [21] Yackey, B. (2008). High-brightness displays: What it takes to take the screen outside. NetWorld Alliance LLC