

## **A Study on the Effective Marketing Implementation through Face Recognition Technology in Smart Digital Signage**

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### **Abstract**

*The aim of this research is to improve the effectiveness of digital media advertising because current advertisements –in digital signage - indiscriminately appeals to the general public rather than to a specific target. In order to deliver efficient and customized advertisement information, an IoT human body detection sensor mounted on digital signage detected human faces and then classified them firstly by gender. The digital signage here is a smart digital signage that can analyze facial signals, discriminate them based on patterns, and apply the extracted data by displaying the corresponding information to the user. In addition, by identifying the customer's location approaching the smart digital signage and displaying the optimized content information for the customer's location through an algorithm, the digital signage can dramatize the advertisement Thus, this is a study meant for improving information efficiency while reducing noise and driving power waste generated from unnecessary digital information reproduction.*

**Keywords:** *Digital Signage, Face recognition, Marketing, LCD Display, Ultrasonic sensor, Media, Sound, Energy, Face Analysis Algorithm, Position Indicator Scope, Time, Image.*

### **1. Introduction**

Digital signage is creating a new marketing area: through the convergence of digital content electronic information and communication technology, high-quality LED devices communicate with potential customers via video, text, various graphics, sound, and lighting. Video showing such variety of digital information displays about 1 million pixels of HD videos(resolution : 1,366 x 768), full-HD about 2 million pixels(resolution : 2,560 x 1,080), ultra-high resolution UHD 4K about 8 million pixels(resolution : 3,840 x 2,160), and 8K about 32 million pixels(resolution : 8,192 x 4,320).

With the development of digital display information technology and face recognition technologies[1-4], customers are required to provide information to customized information services to meet potential market demands such as technology development trends and media information-based social networks services(SNS),

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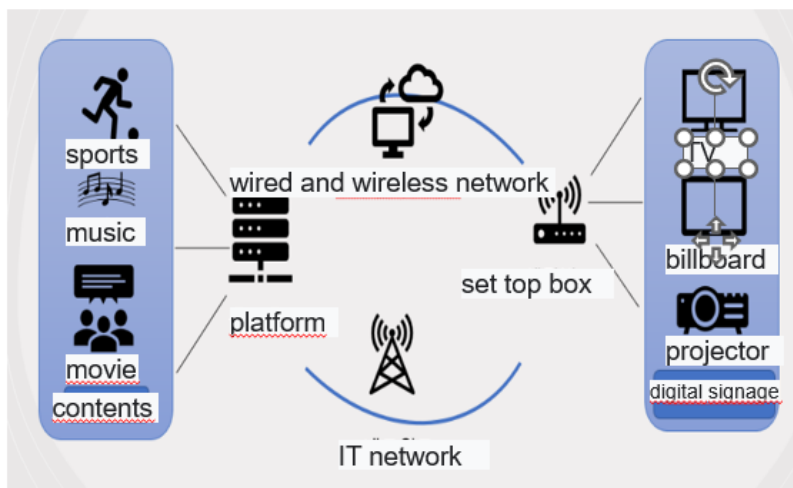
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on-offline marketing environments[5], upheaval[6], various needs of potential customers, and differentiated services for themselves. Figure 1 shows general configuration of digital signage,



**Figure 1. Digital Signage Universal Configuration Diagram**

That is, customer face recognition based customer characteristics data acquisition functions of digital signage facilities are very useful for supporting customer oriented service or customer targeting marketing strategy preparation. However, conventional face recognition technologies[1-4] or other research trends [5-10] are had been studied or considered mainly technical field or marketing area, respectively.

Therefore the research and development requirement and necessity are rapidly increasing related with customer characteristic detection technology and digital signage in various market field. Thus, in this paper, we suggest a study case related to one example of effective marketing implementation models through face recognition technology in smart digital signage.

**2. Signage realtive researchs**

Digital signage-based information expression media, including 3D signage, are installed and operated to efficiently utilize information suitable for the purpose of introduction indoors and outdoors of performances, exhibition halls, public institutions, and financial institutions. However, operating efficiency and effectiveness do not meet expectations, reaching short of the original purposes of introduction such as economic feasibility, efficiency, reliability, and convenience. Conventional related documents[5- 10] and above characteristics, the key hinder factors of signage information transmission, could be summarized as shown in Table 1.

**Table 1. Hinder t Factors of Signage Information Transmission**

A Hindrance Factor	A Key Factor
Random Information Presentation	1. Unable to select target customers 2. Face recognition and gender discrimination classification, age group cannot be determined

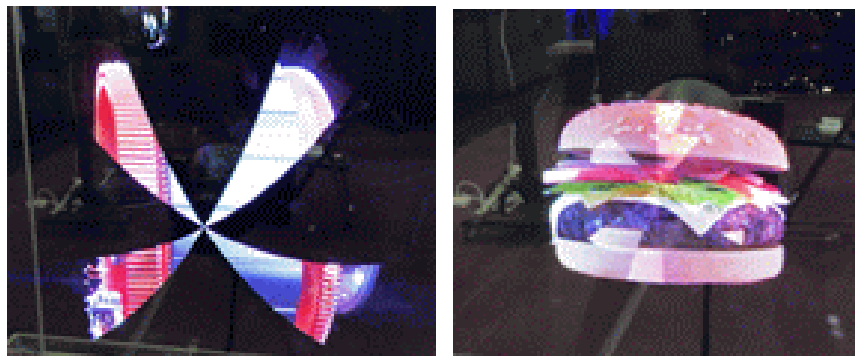
White noise, harmfulness	Out of control efficiently
Energy savings	Unable to control flexible operation

Due to the nature of information and communication devices, the initial investment in digital signage[9] and content purchase, installation, and operation is operated by expensive investment decisions ranging from thousands to tens of thousands of dollars, but the effectiveness of digital signage is extremely insufficient as the reality is that it is difficult to identify economically estimable return on investment (ROI) and break even point (BEP). In order to solve this inefficiency problem, the face recognition classification of 4 layers analysis criteria, white noise efficient control, and energy saving control method were established, presented in the following diagram, and the efficiency of providing content information provided by digital signage was improved.

**Table 2. Functions and Classification Forms for Improving Information Delivery Efficiency**

Function	Classification Type
Acquisition of recognized human body information from digital signage	1st : Classification of 4 classes for men and women of all ages 2nd : Identified as 4 layers of age group - Youths, young people, senior citizens, and the elderly
White noise, harmfulness	Human body detection signal weak (Far) Human body detection signal strong (Near) Efficient control of S/W linkage
Energy saving	Human body detection signal weak (Far) Human body detection signal strong (Near) Power On/Off Flexible Operation Control

Based on the studied technology, the system is designed to improve the efficiency of providing information that allows real-time input of consumer human information through human sensor and face recognition camera on the front of digital signage, accurately determines the input signal according to the criteria in Table 2 above, and provides additional information related to the consumer class. On the other hand, if we are considering signage display technologies, 3D display based information representation skills are very useful. As shown in Figure 2, signage device components could be configured to display 3D Full Color video information by arranging the LED Bar with x-axis and y-axis on the center axis of the motor that rotates 360° at high speed.



**Figure 2. 3D Information Representation System consisting of Four Rotating Media on the x and y axes**

### 3. Algorithm and implementation structure

Although this study provided various information, advertisements, and guidance randomly expressed in the existing digital signage, the efficiency of information provision to potential customers and consumers is lower than that of SNS and Internet-based information services, so it is time to supplement technology.

The satisfaction of potential customers and consumers can be improved by improving efficiency by technological changes regarding time and providing customized information for users. In order to enhance information provision services, content composition, systematically customized information service, database, and face recognition, four-layer analysis information is based on an organic linked service platform to implement information services differentiated from existing digital signage.

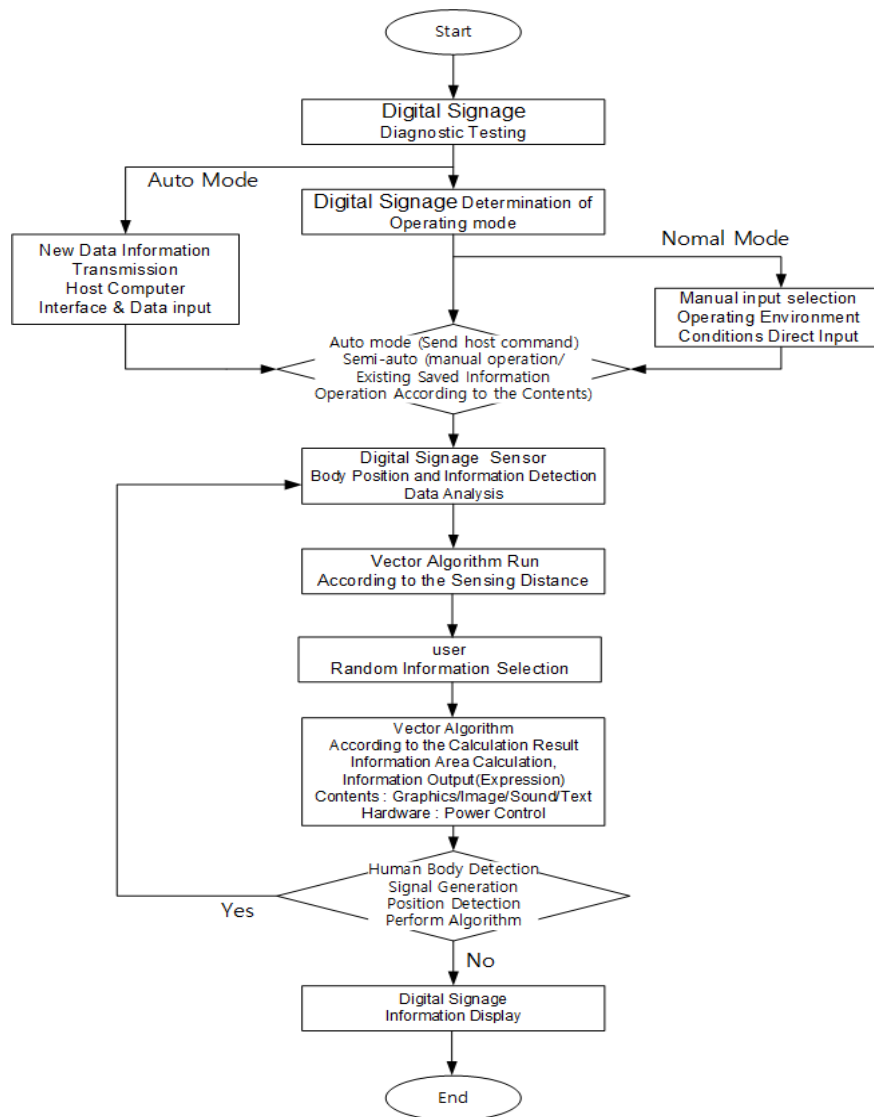


Figure 3. Customer oriented marketing information supporting algorithm

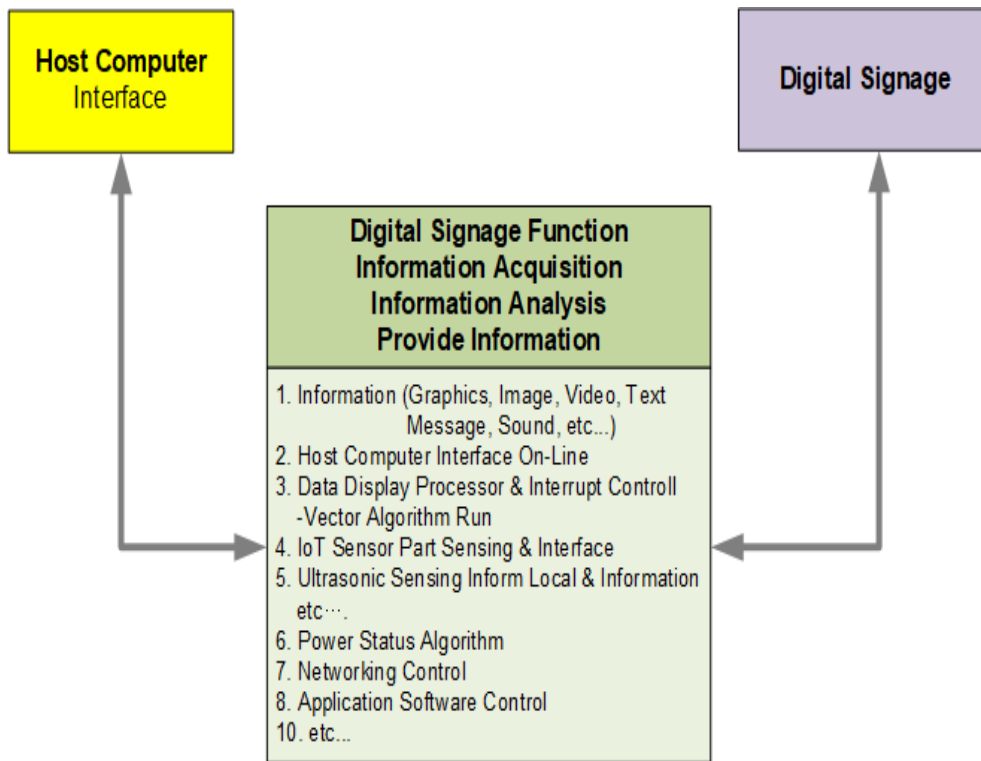


Figure 4. Information acquisition and analysis functions between Digital signage and Host computer

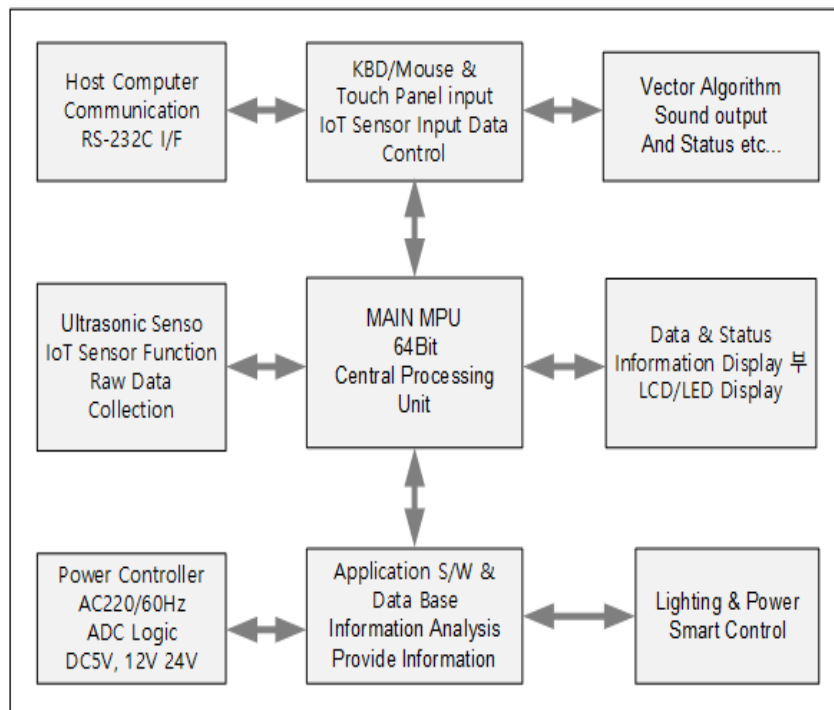


Figure 5. implementation structure of face information recognition in Digital signage

## 4. Results and Considerations

Services that apply face recognition technology can be found around us. Teenagers are enjoying an application that looks for celebrities who look like them by taking pictures of their faces with their smartphones.

A large domestic retailer recently introduced face recognition cameras for testing in some stores. The camera analyzes the purchase pattern by identifying the gender and age range of customers entering the store. In addition, through the camera installed next to the checkout counter, it is possible to figure out how the items purchased by men in their 40s and those purchased by women in their 20s are different.

An official from a distributor said, "In the past, we analyzed customers only with sales data, but now it is possible to analyze which stores and what people do not buy goods but only do 'window shopping' usually go to." Using this face recognition digital signage, it is possible to analyze shopping habits by accumulating customer information through face recognition, provide visitors with various information, advertisements, guidance, and DB.

**Table 3. Comparison of Information Transfer Forms in Digital Signage**

Sort	Original Digital Signage	Smart Signage Converged with IoT Sensors
IoT Sensing	No human body detection No face recognition	4 layers of face recognition classification - Men and women of all ages (Youths, young people, senior citizens, and the elderly)
Information expression	2D information Graphics, Text, Audio	2D, 3D information Videos, Graphics, Text, Audio
Efficiency	Causing white noise Energy-saving Features	Efficient control of white noise Efficient audio control

**Table 4. Service Model with Improved Information Delivery Efficiency**

Sort	Original Digital Signage	Smart Signage Converged with IoT Sensors
Information	Random information presentation	Target information provision service according to the classification of face recognition four layers
Advertisement	Random Advertisement presentation	Preferred advertising service by classification of four layers
Announcement	Random Announcement presentation	Optimal display information customization service according to the classification of four layers
DB	Produced Content Information	Systematically customized DB information for four layers classification Content information

## 5. Conclusion

Currently, digital signage is attracting attention as the new smart digital signage provides information and services indoors and outdoors.

This was based on the development of domestic digital devices, the increase of various creative and

interactive contents, and the incorporation of new IT technologies such as facial recognition technology, which enabled the creation of new business areas with new items in the convergence era. However, despite the rapid growth of the digital signage market, there are no technical indicators, and the market has not been activated due to concerns over the possibility of personal information leakage and regulations under the Outdoor Advertising Act. To address these problems, the government and companies solve digital signage-related problems in their respective locations and develop advanced and competitive IT technologies to study content so that the effect of digital signage can achieve maximum synergy based on these technologies in terms of service. If these matters are reflected, the domestic digital signage market is expected to be more active. The convergence media environment around us is developing into an environment where intelligent technology can be applied by providing advanced customized targeting signage that allows user participation. If smart digital signage develops in line with these changes, it will be able to develop into a service that provides customized information for gender and age and provide an efficient environment for institutions and viewers by reflecting customer needs.

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