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Development of Smart Bags Using E-Paper Reflecting the Characteristics of Mz Generation

Heeji Choi[1] and Youn-Hee Kim[2]*

[1]*Master's Course, Department of Convergence Design and Technology, Kookmin University, Korea*
[2]*Assistant Professor, Department of Convergence Design and Technology, Kookmin University, Korea*
[1]*hichio1228@kookmin.ac.kr and* [2]*shell62@kookmin.ac.kr*

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***Abstract* - Recently, in the fashion industry, more and more companies are pushing for product development targeting the MZ generation who adapt well to change and are not resistant to new technologies. The MZ generation is a generation that grew up with digital devices and is becoming a major consumer base in the smart fashion industry as it can use digital technology skillfully. Therefore, Therefore, this study developed a smart bag using E-paper technology a smart bag using E-paper technology based on the characteristics of the MZ generation. After examining the types, characteristics, and examples of E-paper displays through related literature, It was discovered that microcapsule displays based on electrophoresis technology are most suitable for use in daily life with excellent readability and low power. Through previous research, the characteristics of the MZ generation were examined. These are: the characteristics of digital native generation, cloud consumption characteristics, fun-seeking fundamental characteristics, balance consumption, and flex culture. This study is significant because it presents smart fashion products using E-paper technology targeting the MZ generation, which is rapidly emerging as a center of consumption.**

Keywords: MZ generation, Characteristics, E-paper, Smart bag, Smart fashion

1. INTRODUCTION

As electronic technology develops rapidly, various products using wearable technology that combine different fields such as engineering and fashion are being researched and developed. In particular, the development of technology convergence has made it possible to realize functions that seemed impossible and maximize imagination and creativity (Na & Park, 2012; P.131). With the ability to create products with various complex functions, companies are introducing wearable products to consumers by combining them with various fashion items (Manideep & Reddy, 2021). Except for smartwatches, bands, and earwear, which account for the highest shipment and market share in the wearable market, wearable products are expected to be a new industry sector with low shipments and market share but high growth rates (Baek, 2019). Among them, wearable fashion products incorporating E-paper are actively being developed, and various content-based products are being introduced to the market. Wearable products may be unfamiliar and difficult to older generations, but the MZ generation, which is flexible to change, can quickly adapt to new things and digital technologies. Consumption forms that enjoy showing and sharing their individuality and tastes to others and values self-directed behavior dominates the MZ generation. Since this type of consumption has a significant influence on consumer and companies that sell products, companies are paying attention to the MZ generation to satisfy consumers along with product development. Therefore, the development of wearable products that incorporate E-paper technology to suit the lifestyle and participatory consumption characteristics of the MZ generation that enjoy revealing and sharing themselves through the personality and taste of the MZ generation is looking for growth and expansion into various contents of the smart fashion industry. Hence, this study investigates and analyzes cases of design, the purpose of this study is to investigate and analyze cases of design using E-paper and to develop E-paper smart bags targeting the MZ generation.

Through related literature and internet data, this study investigated first the definition of E-paper and derived the characteristics of each type of display to select a suitable display for a bag. Second, it examined the design characteristics through a product case study using E-paper. Third, the researches considered the definition and characteristics of the MZ generation to fit the functions and aesthetic indicators for bag design. Finally, we developed smart bags of E-bag and E-backpack that reflect the characteristics of the E-paper display, product case, and MZ generation.

2. THEORETICAL CONSIDERATION

2.1. Consideration of E-paper

2.1.1. Definition and Characteristics of E-paper

E-paper refers to an electronic device that can not only act as a paper but also feel the feeling of the paper ("E-paper", n.d.) It is a digital paper with the best visual characteristics among display media. As a reflective display, it has excellent readability due to its wide viewing angle, high resolution, and high contrast between bright white backgrounds and particles like conventional paper and ink. There are about 20 methods of E-paper depending on the image implementation method, and among them, there are four methods of performance that are close to commercialization. These are Gyricon display, electrochemical deposition display, cholesterol liquid crystal display, and microcapsule display.

First, the Gyricon display is a hemispherical twisted ball type display. Millions of small balls are scattered between two transparent plastic or glass plates in the oil-filled Elastomeric matrix cavity, which is a black and white hemisphere with a positive charge on one side and a negative charge on the other. Information and images are implemented by displaying black and white when the ball is rotated by the voltage applied from the outside outside in its black and white area. Decreasing the size of the ball the ball has the advantage of speeding up image transition and lowering the voltage to drive the display, but as the resolution limit and the number of pixels increases, the electric field control of the display becomes more complicated (Lee et al., 2010, p.4). Figure 1 was the first E-paper developed by Xerox in 1975, developed using Gyricon display technology.

Second, the electrochemical deposition display is a display method developed by Sony that uses electrochemical deposition and decomposition reactions of metal ions dissolved in a solid electrolyte. Compared to the method, the safety of the reversible reaction according to the application of the electric field is significantly deteriorated over time, resulting to limitations in realizing full colorization, and distinct change in the deposition characteristics of display components on curved surfaces ("E-Paper, spotlighted as next-generation display", 2012). Figure 2 is Sony's display made using electrochemical deposition technology.

Third, a display using cholesteric liquid crystal was developed in 1993 by Kent. It operates based on LCD technology, but has the characteristic of expressing color by selectively reflecting different wavelengths of light from LCD that passes light through sub-pixels. Also, this technology consumes a lot of power, but video display is possible (Lee, 2010, p.977). Figure 3 is an E-paper display based on cholesteric liquid crystal technology developed by Kent, and is a product named Sparkfun.

Fourth, microcapsule display is a technology based on electrophoresis, which means the rapid movement of charged particles in a colloidal suspension in an electric field. It is characterized by less eye fatigue and lower energy consumption. Although they show excellent display reliability and stability, direct drive is efficient for applications for low information content and active matrices should be used for high-resolution images. In addition, it is difficult to implement full color, and the operation speed is slow, so there is a limit to realizing a video (Kim, 2009]. Figure 4 is the Aurora FLS of E-ink, a representative company that makes products based on microcapsule display technology. Table. 1 summarizes the types and characteristics of each display.

Table 1: Types and features of E-paper displays

Display	How it is implemented	Characteristic	Image
Gyricon display	• Realized through the contrast of the different sides of the hemisphere	Advantages • Fast image switching • Low power Disadvantages • Limitation of resolution	 **Fig 1.** Gyricon display from Xerox
Electrochemical deposition display	• Utilizing the electrochemical termination and decomposition reaction of metal ions dissolved in the solid electrolyte	Advantages • Low power Disadvantages • Limitations of color implementation	 **Fig 2.** Electrochemical deposition display from Sony
Cholesteric liquid crystal display	• Works based on LCD technology • Selectively reflects different wavelengths	Advantages • Wide viewing angle • Video display available Disadvantages • Consumes a lot of power • High manufacturing cost	 **Fig 3.** Sparkfun from Kent
Microcapsule display	•Based on the rapid movement of charged particles in colloidal suspension in an electric field (electrophoresis) • Most used technology	Advantages • Excellent resolution • Low power • High reliability and stability Disadvantages • Limitation of full- color implementation • Slow moving speed	 **Fig 4.** Aurora FPL from E-ink

2.1.2. Analysis and Characteristics of Fashion

Product Application Aases using E-paper

This study develops a smart bag using E-paper technology. The scope of E-paper's application case investigation and analysis focused on it being a commercialized fashion product, and it was analyzed by dividing it into functional and design features.

As a result of analyzing product cases, most products using E-paper technology have three characteristics. First, black-and-white or low-color display effects express analog sensibility that stimulates the user's sensibility rather than emphasizing the technical parts of colorful colors. There are two typical examples of E-paper fashion products. Figure 5 is a T-shirt using WearTRBL's E-paper, and the image can be changed through Bluetooth and mobile apps. Functional features include washability, up to four days of use on a single charge, the ability to download designs for display via a website, and the ability to store up to 20 images. As for the design feature, at the purchase stage, the user can select and purchase the desired design among gray and black for the color of the T-shirt and short-sleeve or long-sleeve for the sleeve. In addition, the developed T-shirt has a characteristic of stimulating the user's analog sensibility through the black and white image on the display on the chest. Figure 6 Sony developed a smartwatch equipped with an electrophoretic technology-based E-ink display not only on the watch dial but also on the strap. As a functional feature, the design of the watch dial and strap can be changed through a dedicated smartphone app, and up to 24 designs can be stored in the smartwatch, and the saved designs can be easily changed by pressing the button attached to the watch. The design features can be customized depending on the design choice of the user through the display on the watch dial and strap, and you can feel the analog sensibility as only black and white colors can be shown through the display of the watch.

Second, It can also be used easily and conveniently especially in sending images through products and communities or apps that consider, such as sending images through products and communities or apps that consider usability and convenience with low power consumption, which is an advantage of E-paper. There are four representative examples. Figure 7 shows a smart shoe from Ishuu Technologies. Its functional feature is that a Bluetooth device is attached to the bottom of the shoe, so the external display design of the shoe can be changed through an app, and it can be used only with wireless charging once every 2-6 months. In this way, usability and convenience are sought. The design feature is that the ankle strap is detachable and can be customized. Shiftwear has developed smart shoes that are completely waterproof and washable, and are highly durable using materials used in bulletproof vests. These smart are designed as sneakers and can be charged by walking sneakers and can be charged by walking, so they can be used without separate charging. As shown in Figure 8, the image on the display can be converted through the app, and the design used for the display can be downloaded through the website, resulting in usability and convenience characteristics. As for the design feature, in addition to the basic colors of white and black, the color of the smart shoes can be customized and purchased by the user at the purchase stage. Tago developed a smart bracelet, and the functional characteristics of this bracelet were that it could be charged with a smartphone even during image transmission through NFC connection, and that it could be easily and conveniently changed to the design desired by the user using an app, resulting in usability and convenience. As for the design features, besides the display design, the frame of the smart bracelet, the frame of the smart bracelet can be customized by selecting from three colors of black, gold, and silver as shown in Figure 9 at the purchasing stage. Phosphor has developed a smart watch that incorporates E-paper technology, and unlike commercially available smartwatches, a dual time zone display that can display two time zones at the same time is a representative feature. Users can set the desired time zone among 24 time zones by simply by pressing the button at the bottom of the smartwatch. At this point, usability and convenience characteristics have emerged. In addition, when displaying the date and time, the display size can be adjusted and the color of the text and display background can be switched to black and white. As for the design features, as shown in Figure 10, it is designed to be as thin as 9.3 mm thick, and it is the only smart watch with a curved shape. The band of the watch can be selected from leather, polyurethane or steel materials, so it can be customized according to the user's taste.

Third, the user's personality can be expressed through the process of directly customizing the external design and display image, and there are two representative examples. Gligo in Figure 11 is an example of a hybrid smartwatch. is a hybrid smart watch. In terms of batteries, the battery life, the battery life of the E-paper display is up to six (6) months, and the battery life of the watch is about two (2) years, which is the longest battery life among currently developed smart watches. In addition, it has a functional feature that can be changed according to the user's

purpose, as the user can customize the function in real time through a dedicated smart watch app. As for the design features, at the purchase stage, you can choose the material for the exclusive strap from leather and mesh straps, and you can choose the color from silver and black, so you can customize it according to your personality and taste. Unlike commercially available smart watches, Empatica developed a medical smartwatch that incorporates E-paper technology. The world's first FDA-approved watch in the field of neurology is the wearable device of choice for monitoring astronauts' health, managing their physical and mental health. As for the design features, it has the thinnest thickness among smart watches, as shown in Figure 12, and has the feature of being able to customize the size of the watch, the color of the frame and the band at the purchase stage. Table 2 summaries the application cases of E-paper fashion products discussed above.

Table 2: Application of fashion products based on E-paper technology

Characteristics	Brand	Item	Feature		Image
			Functional	Design	
Analog sensibility	Wear TRBL	T-shirt	• Washable • Battery up to 4 days • Store up to 20 images	• T-shirt color and sleeve length can be selected	 **Fig.5.** WearTRBL – T Shirts
	SONY	Watch	• Save up to 24 designs and change them with the press of a button • Microcapsule display	• Display image of watch dial and strap can be switched	 **Fig 6.** SONY – Watch
Sability and convenience	Ishuu Technologies	Shoes	• Change design via smartphone app and Bluetooth • Wireless charging available • Microcapsule display	• Detachable ankle strap	 **Fig 7.** Ishuu Technologies – High heels
	Shiftwear	Sneakers	• Change the exterior design of the shoe • Waterproof and machine washable • Can be charged by walking power	• Shoe color can be customized	 **Fig 8.** Shiftwear – Sneakers
	Tago	Bracelet	• Charging by NFC during image transfer • Microcapsule display	• Bracelet frame color can be customized	 **Fig 9.** Tago – Bracelet
	Phosphor	Watch	• Simultaneous representation of two time zones • Microcapsule display	• Unique curved frame among smartwatches	 **Fig 10.** Phosphor – Watch
Individuality expression	Gligo	Watch	• Hybrid smartwatch • Functional customization with dedicated apps • Microcapsule display	• In addition to colors, it can be customized with exclusive leather and mesh straps	 **Fig 11.** Gligo – Watch
	Empatica	Watch	• A watch that monitors the health of astronauts • The world's first medical smartwatch • Microcapsule display	• Thinnest smart watch • Customizable display size and band color	 **Fig 12.** Empatica – Watch

Among fashion product application cases using E-paper, the products whose technology was disclosed were developed using microcapsule displays with the same principle as Figure 13. This is because it is suitable for daily use with excellent readability and low energy consumption compared to other displays, so this study aims to develop a smart bag using a microcapsule display.

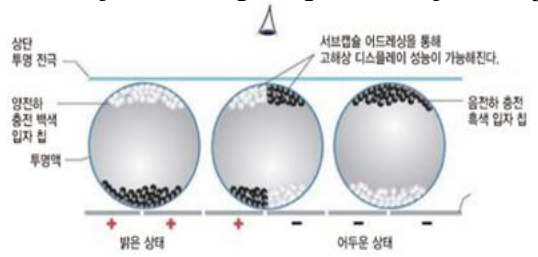

Figure 13: Microcapsule display technology principles

2.2. Consumption value Characteristics of the MZ Generation

Generation MZ is a collective term for the 'millennial generation' born between the early 1980s and the early 2000s and the 'Z' generation born between the mid-1990s and early 2000s (pmg Knowledge Engine Lab., 2021). Currently, the youth group is in their early teens to early forties. As a digital native generation, they can utilize and accept digital technologies, and are familiar with the digital environment, and are familiar with the digital environment such as smartphones and the Internet. They also prefer visual elements such as videos and images. videos and images. In addition, because the MZ generation pursues a differentiated consumption culture in which they pursue fun, actively express themselves, and even share it, the barrier to entry into smart products with wearable technology is relatively low compared to other generations. According to previous research, the characteristics of the MZ generation can be divided into five Space. First, this generation grew up in the digital environment and are active in using information technology. Second, those who belong in this group value individuality according to one's own personality and taste. Third, MZ generation values experiential consumption that value experience and sharing. Fourth, this generation loves the pursuit of pleasure and interest. Fifth, members have a balanced consumption that emphasizes cost-effectiveness (Lee, 2020, pp.30-51). Previous studies state that the digital native generation is skilled at dealing with the internet and various digital devices. The members of this generation are fun consumers and feel better when consuming. Most of them also like the "flex culture" for their individual satisfaction (Lee, 2021, pp.39-40).

These studies further revealed that the MZ generation can be characterized as value-consuming, where they like mining out, flexing for themselves, and having fun buying because of the price rather than the cost-effectiveness. They are also on-tact shoppers who are skilled in digital media and are satisfied with sharing rather than owning (Jang, 2021, pp.14-15). Moreover, available literature describes the MZ generation as more flexible with changes than other generations. They are familiar with the online world, thus having proficiency in social media. They also feel more satisfied with sharing products and services rather than owning them. Moreover, flexing the products and services they purchase is a way for them to show off their success or wealth. After all, the MZ generation prioritizes using mobile devices and pursues new or exotic things (Jeong, 2021).

The results of the analysis of previous studies about the consumption value characteristics of the MZ generation compelled the researchers to develop an E-paper smart bag. The development of the E-paper smart bag is primarily based on such characteristics. The results of the analysis of previous studies about the consumption value characteristics of the MZ generation compelled the researchers to develop an E-paper smart bag. The development of the E-paper smart bag is primarily based on such characteristics. Table 3 summarizes the data gathered from previous research on the consumption value characteristics of the MZ generation.

Table 3: Characteristics of E-paper smart bags and consumption characteristics of MZ generation

A prior researcher	Consumption value characteristics of generation MZ	Characteristics of MZ generation's consumption
Eun-kyu Lee (2020)	• The digital generation • Emphasis on individuality • Experiential consumption • The pursuit of fun • Balanced consumption	• Digital native generation • Cloud consumption • Fun-consumer • Emphasis on individuality • Balanced consumption and flex culture
Ju-young Lee (2021)	• Digital native generation • Fun-consumer • Flex culture	
Yoon-jung Bang (2021)	• Meaning out • Flex culture • Fun for the price • An ontact shopper • Cloud consumption	
Cheol-ho Jeong (2021)	• Flexible to change, online familiar, SNS proficient • Satisfied with sharing rather than owning • The pursuit of something new and unusual • Flex culture	

3. USER SCENARIOS AND SYSTEM DESIGN

3.1. Hardware Design

Arduino DUE, Waveshare's 7.5inch E-ink display module, and 2.13inch E-ink driver were used for the

hardware design needed to make the bag. Waveshare's E-ink display module is a microcapsule display based on electrophoretic technology among the four displays discussed above, and has the advantage of being able to display images and text clearly with excellent resolution and readability. The used display module can express not only white and black but also yellow, but the Korean language is not compatible, so the need to use English when displaying characters becomes a disadvantage. E-ink driver was used to connect with Arduino, and the configuration and design of Arduino DUE and E-ink driver is as shown in Figure 14.

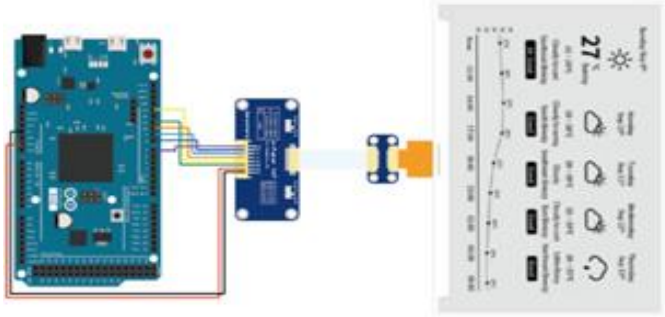

Figure 14. Arduino Due and E-ink display configuration and design

3.2. Software Design

The software design was constructed so that images and information can be customized according to the purpose and situation of the user who belongs to the MZ generation. In this study, the images of Mickey Mouse and Keith Haring were modified to 640x384 pixels to match the display size by color, and the file format was set to 24 bitmap and stored. These images were converted into a format for E-paper using a converting program provided by Waveshare. Arduino and E-ink modules were then connected, and Arduino's reset button is pressed to refresh the display and output of the uploaded image. In this way, it was programmed to download images that users wanted, display weather information (temperature, humidity, fine dust, etc.), and to develop E-bag and E-backpack based on E-paper application case studies and MZ generation characteristics.

3.3. DESIGN

1) E-bag

The E-bag is a rectangular handbag. Figure 15 shows the bag is designed with a geometric handle to fit the hard shape of the square and to ensure originality. There is also a separate space inside the bag to fix the E-ink display module. By inserting the E-ink display module into this space, the screen can be viewed in the front portion of the bag. Since the space might be if the module is put inside the bag, a pocket was added at the back of the bag to supplement the storage capacity. The pocket was designed using a different color for individualization. Hard materials and cool natural leather were used to construct the bag to minimize the sense of difference. This is also so that it can harmonize with the display which is an electronic device. The color and leather design of the smart bag can be customized according to the display image, showing individualized expression and jolly customization characteristics. The virtual scenario was conceptualized so that when a user goes to a concert hall or amusement park, there will be a customization of the signature characters, images, and logos of the performance or amusement park on the display of the bag to form a friendly and emotional bond. Black and white Mickey Mouse was designed on the display of the E-bag, and through this, analog sensibility can be stimulated. In addition, through the process of converting the display image, the user's direct experience, interest, and pleasure are induced, and the characteristics of experiential consumption fun pursuit are shown. The detachability of the display and image conversion can be changed according to the user's situation and purpose, resulting in multipurpose characteristics.

2) E-backpack

The E-backpack was designed in the form of a rectangular backpack. Figure 16 shows that the storage capacity was supplemented by adding a pocket for the E-ink display module at the front of the bag. In addition, this pocket can be attached and detached using a snap button. The separated pocket can also be used in the form of a clutch bag, resulting in versatility that can be customized according to the user's situation and purpose. Natural leather is the material used and white is the base color and navy blue is used as the point color. The color and leather design can be customized according to the user's preference, so it has personality expression and playful customization characteristics. In the virtual scenario, when the user's desired weather information is a fine dust or some ultraviolet rays, it is eventually designed on the display of the smart bag. Not only the user, but also people

around can check it by alerting the user or helping him or her prepare. Table 4 summarizes the design and characteristics of E-bags and E-backpacks.

Table 4: Smart bags using E-paper

	Scenario	Design	Product image
E-bag	ex) When you go to a performance hall or amusement park, you can enjoy the atmosphere by displaying the signature character, image, or logo of the performance or amusement park	Exterior design • Handbag • Geometric handle • Side pocket Inside design • Separation divider for e-paper board • Removable display Material Natural leather Colors • White • Black • Burgundy	 **Fig 15.** E-bag
E-backpack	ex) Displays user-desired weather information such as fine dust and ultraviolet rays to pay attention to safety	Exterior design • Backpack • Bag loop • Detachable display pocket with snap button Inside design Material Natural leather Colors • White • Navy	 **Fig 16.** E-backpack

4. A STUDY ON CONSUMPTION VALUE AND E-PAPER SMART BAG CHARACTERISTICS OF MZ GENERATION

4.1. Personality Expression and Playful Customization

The external design of the E-paper smart bag can be customized according to the user's personality and taste by configuring the user's desired color or changing the design of the display, …resulting to individual expression and playful customization refers to a kind of custom-made service in which manufacturers or craftsmen make products according to the customer's needs (“Customizing”, n.d.). Studies state that customization can be classified into three types. customization can be classified into three types. First, the appearance selection type of the finished product that gives visual changes. Second, the selective product completion type that selects and completes the product according to one's taste before the product is made. Third, the cooperative product completion type that cooperates with the company to complete the product according to the taste of consumers (Kim, 2011, P.16). Such customization service, in which consumers directly participate, has the advantage of not only increasing the sales of the corresponding product, but also enabling consumers to receive desired products and services. Figure 17 shows the process of customizing the color and leather design of the smart bag. Figure 18 shows how the image can be continuously customized according to the user’s personality and taste. Such customization process can satisfy the characteristics of valuing one's own individuality among the consumption characteristics of the MZ generation.

Figure 17: E-paper smart bag customizing

Figure 18. Customizing the E-backpack

4.2. The pursuit of Experiential fun

The E-paper smart bag has a function and design characteristics that enable storytelling with a display image. Storytelling, a combination of "story" and "telling," refers to the act of persuasively conveying

what you want to tell the other person in a vivid and funny story, especially recently, it is also used as an effective communication method in modern organizational society ("Story telling", n.d.). According to the results discussed above, the MZ generation is a digital native generation and is more suitable for using E-paper smart bags than other generations because there are many users who find it less difficult when using displays proficiently. In addition, as shown in Figure 19, through the process of modifying the image directly by the user, the user's active participation can be drawn, the experience consumed, and fun can be enjoyed. Through this, the fun-consumer characteristics of the MZ generation who pursue pleasure and interest and the characteristics that value experiential consumption based on independence, autonomy, and activity can be reflected.

Figure 19. Image color adjustment for E-paper display

4.3. Multi-purpose Characteristics

As shown in Figure 20, the E-paper smart bag is a multi-purpose bag since the place or the situation where the user is into and the purpose he or she wants to see (dates, weather, and time) can be displayed. The display image or text displayed in the smart bag may be changed and it can also be redesign by turning it into a clutch bag by separating the outer pocket part of the display. The flexibility and compatibility of the backpack or clutch bag depending on the time, place, and occasion (T.P.O) reflect the characteristics of the MZ generation, which values cost-effectiveness and pursues balanced consumption that meets only as needed.

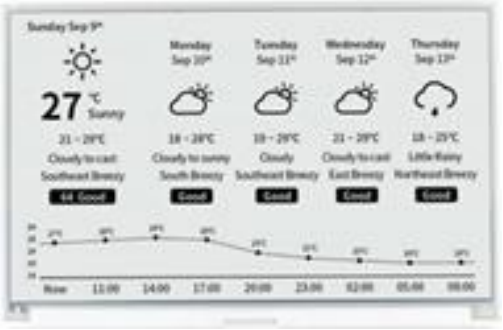

Figure 20. E-paper display for smart bags that can be changed for context and purpose

4.4. Analog Sensibility

Analog sensibility refers to the old sensibility felt in the era before digital technology developed ("Analog Sensibility," n.d.). It may not seem related to the MZ generation who grew up in the digital environment, but if you look at some recently uploaded articles, you can see that the MZ generation is enthusiastic about analog sensibility and is looking for it (Kim, 2022). This is an act of searching for human sensibility that is lacking in the digital age, and it is a memory for the older generation, but it is more of a modern activity to pursue a new style with a material that was popular in childhood for the MZ generation (My Own Things Nowhere: MZ Generation and Personalization, 2021). The method of displaying analog images or phrases desired by the user can not only consume the user's memories and experiences, but also express individuality, which can arouse the interest of the MZ generation. Figure 21 shows a display which uploaded a black and white image of an E-paper smart bag. Through this, it can stimulate analog sensibility because it creates a nostalgic feeling of the past. Figure 22 shows that the consumption value characteristics of the MZ generation were reflected in the characteristics of the developed E-paper smart bag.

Figure 21. Analog sensitivity through black-and-white image of E-paper display

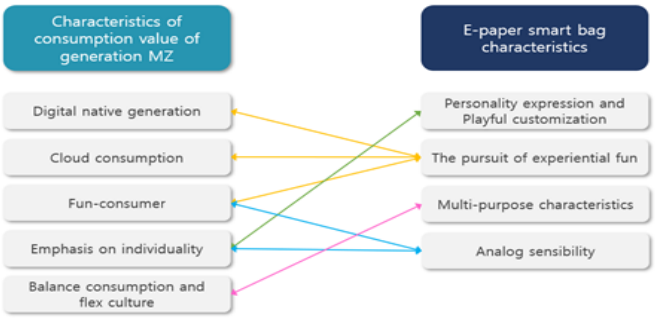

Figure 22. Characteristics of the consumption value of the MZ generation and the characteristics of smart bags using e-paper

5. CONCLUSION

With the development of technology convergence, wearable products are being researched and developed. Flexible to change and proficient with technology, the MZ generation emerges as a major consumer. Companies are paying attention to the MZ generation to develop products that reflect their consumption culture characteristics. Accordingly, the development of wearable products that incorporate E-paper technology to suit the participatory consumption characteristics and lifestyle of the MZ generation seeks the possibility of growth and expansion into various contents of the smart fashion industry. In this study, an E-paper smart bag that reflects the characteristics of the MZ generation was developed based on the results of the case survey and analysis using E-paper. The results of this study are as follows. First, there are four methods that show the best performance and performance that are close to commercialization: Gyricon display, electrochemical deposition display, cholesterol liquid crystal display, and microcapsule display. Among the four displays, this study used a microcapsule display to develop a smart bag. This type of display was chosen because it is suitable for daily use, has excellent readability, and has low power consumption. Second, through previous research, the MZ generation's consumption value characteristics were derived into five categories: digital native generational characteristics, cloud consumption characteristics that value sharing over ownership un-consumer characteristics that pursue fun, and cost-effectiveness and flex characteristics. Third, pursuing individuality and fun was possible because the developed E-paper smart bag can customize the color and leather design of the smart bag, change the image of the display according to the user's personality and taste, and download or change the design according to the user's T.P.O. In addition, it has a multi-purpose characteristic because it can be designed in consideration of the user's use location and situation, and analog sensibility was derived through the black-and-white sensibility of the display. For further studies, the researchers will develop, we will develop an app or online platform for E-paper bags to be a system environment in which users can design themselves and download designs made by other users. This paper is meaningful in that it presents smart fashion products that can be customized by incorporating E-paper technology targeting the MZ generation, which is rapidly emerging as a center of consumption.

6. ACKNOWLEDGEMENTS

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