DISSEMINATION OF DIGITAL HERITAGE USING MEDIA TECHNOLOGY - INTANGIBLE CULTURAL HERITAGE OF KOREA, DONGNAE CRANE DANCE -

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ABSTRACT
The digital transformation of cultural heritage is being pursued in various ways to enhance public awareness and accessibility through the use of media technology. This study focuses on converting the motion data of the bearer of the Intangible cultural heritage *'Dongnae Crane Dance'* in Busan, Korea, into digital media content. Research findings enables the exploration of ways to go beyond the conservation and transmission of cultural heritage in its original form, to widely disseminate it as sustainable digital heritage to contemporary users. This study is expected to serve as a starting point for the general public to re-evaluate the value of digital heritage and induce positive changes in perception. It is anticipated that the dissemination of the cultural value of the *'Dongnae Crane Dance'* through various media in the future will create multifaceted added value.

Keywords: Intangible Cultural Heritage, Digital Heritage, Digital Transformation, Digital Media Content

1 INTRODUCTION

Countries around the world are increasingly recognizing the importance of preserving their unique cult ural heritage as a key element in shaping national identity. In an effort to preserve and utilize their cult ural heritage, they are taking various measures[1].

The Korea Heritage Service's framework for cultural heritage utilization consists of three stages: production (investigation, excavation, research), preservation and management (restoration, preservation, management), and utilization (application, dissemination, diffusion). This preservation system connects the value chain from the discovery to the utilization of cultural heritage[2]. Tan and Rahama argued that effective interpretation and experience of digital heritage sites require a comprehensive method that accommodates diverse end-users, addresses narrative linearity, manages subjectivity in content creation[3]. They emphasize the need for methods that provoke thought instead of merely instructing, aligning with Freeman Tilden's view that interpretation should reveal meanings and relationships through direct experience and media, rather than just convey factual information[4]. Therefore, to enhance public awareness and empathy towards cultural heritage, it is necessary to develop utilization methods that disseminate cultural heritage from the user's perspective, going beyond the traditional viewpoints of conservation and transmission.

Around the world recognizes cultural values and potential of cultural heritage as important assets that must be actively preserved and protected. In particular, the Intangible cultural heritage of dance, which heavily relies on human transmission, increasingly necessitates the use of digital technology for recording and preservation to prevent its disappearance.

Motion capture, a prominent technology for digitally recording Intangible cultural heritage, precisely digitizes human movements to document and preserve the actions of traditional performers[5]. A notable example occurred at the 2016 International Intangible Heritage Film Festival in *Jeonju*, where the "*Salpuri* Dance" by the Mrs. Lee Maebang (former honorary bearer) was recreated as a hologram using motion capture data, allowing his daughter to perform alongside it[6]. Additionally, the "300 Years of

Hakka Kungfu" exhibition digitalized Hong Kong martial arts to spread the value of Intangible cultural heritage[7]. While utilizing advanced technology to replicate Intangible cultural heritage sustains its vitality and spreads its value, it faces limitations in maintaining long-term public interest. Therefore, there is a need to continuously expose Intangible cultural heritage content through highly accessible media to keep the public engaged.

This project aims to record the dance movements of Mr. Lee Seonghune the bearer of the Dongrae Crane Dance, an Intangible cultural heritage of *Busan* (Korea), using motion capture technology for conservation and transmission. Additionally, by utilizing the bearer motion data through digital media content, the project seeks to widely disseminate this heritage to a diverse audience, thereby establishing it as a digital heritage.

2 BACKGROUND

2.1 Korea '*Pungnyu*' (풍류/風流)

'*Pungnyu*' as the source of East Asian aesthetics, can be understood as a form of play or game between humans and nature. It is not merely a superficial observation of appearances but rather a deep engagement with the essence of phenomena, where one reaches the core of their true nature through playful exploration. The term '*Pungnyu*' literally means *"to flow with the wind,"* suggesting a state of effortless movement without attachment or constraint, and can be viewed as a cultural phenomenon that embraces play or playfulness[8].

This concept is shared across Korea, China, and Japan, though with regional variations in emphasis. In China, '*Pungnyu*' highlights freedom and unrestrained spontaneity. In Japan, it takes on a more aestheticized meaning, emphasizing elegance, refinement, and the beauty of external appearance. In Korea, however, '*Pungnyu*' manifests in a more philosophical and spiritual manner, with a focus on religiosity and thought. This can be seen in the concept of '*Sininmyohap (神人妙合)*', which refers to the mystical union between gods and humans as co-subjects seeking integration. This idea is reflected in traditional Korean practices such as '*Pansori*', '*Salpuri*', and '*Gut*', where the intervention of nature or spiritual forces is invoked to resolve human issues[9]. In this context, Korean '*Pungnyu*' functions as a mediator between the human world and the divine, where art becomes an act of ritual imbued with a strong shamanistic character.

Thus, Korean '*Pungnyu*' can be described as a state of entering into nature, breathing in harmony with it, and physically attuning oneself to the rhythms of life that nature evokes. It signifies an awakened and open mindset that is receptive to the universe and all living things.

The spirit manifested in Korean Pungnyu can be explained through three distinct types. First, there is '*Heung (興)*', an energy that exudes positivity and brightness, actively engaging with reality through a lens of optimism. Second, '*Han (恨)*' reflects a passive, often melancholic view, embodying a sense of alienation and the internalization of a negative or sorrowful perspective on life. Lastly, '*Mushim (無心)*' represents a transcendent state that moves beyond the dualistic thinking of positivity and negativity, good and evil, joy and sorrow, a sense of detachment and equanimity toward the world.

Thus, the essence of Korean '*Pungnyu*' lies in the dynamic interplay of these three elements, which fluidly interact and harmonize with one another within a larger whole. This harmonious relationship becomes a vehicle for expressing the unique beauty of Korean aesthetics.

2.2 Dance using birds in intangible cultural heritage

Dances that imitate the form or movement of birds exist not only in Korea but also across the world. This can be attributed to humanity's admiration for birds' wings, which symbolize the desire to soar freely. In Korea, a specific dance centered around the crane has been preserved as part of its intangible cultural heritage. This dance reflects the essence of '*Pungnyu*', Korea's aesthetic philosophy, symbolizing the transmission of divine virtues to humanity through the crane, as well as embodying images of longevity and prosperity.

Korea's intangible cultural heritage utilizing these techniques appears in two forms as follows.

The first is a dance where people wear masks and costumes in the shape of cranes and dance like real cranes. This is a court dance designated as Important Intangible Cultural Property No. 40. In this dance, performers wear masks and costumes resembling cranes, imitating the crane's movements, such as shaking its body, pecking at the ground with its beak, and touching beaks together before pulling

away[10]. The second is the *'Dongnae Crane Dance'*, an intangible heritage of Busan, where dancers wear white robes and black hats, resembling the elegant figure of a crane[11]. This dance, named after the crane due to its visual similarities, highlights the free-spirited improvisation and personal flair that embody the core of Korean *'Pungnyu'*.
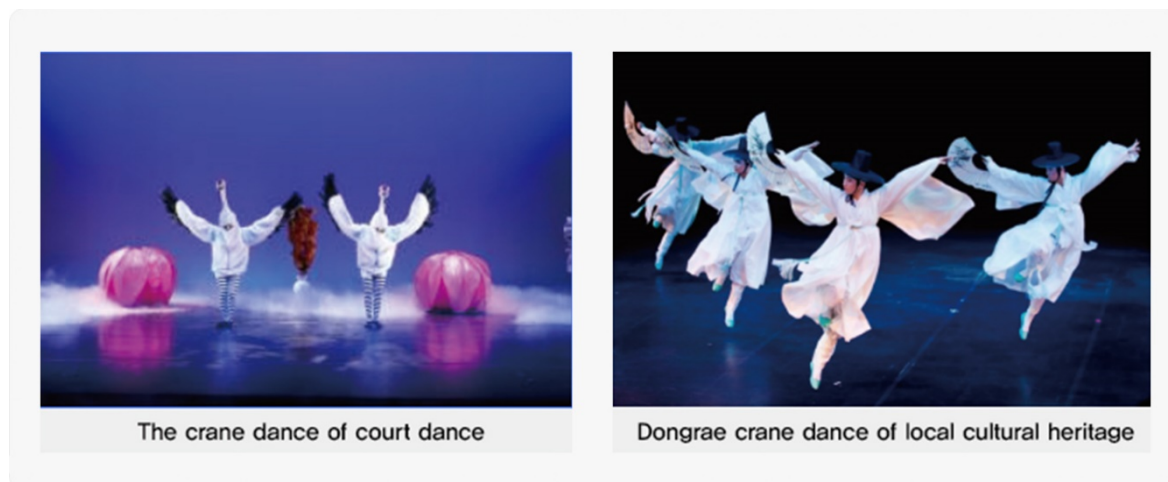

The crane dance of court dance

Dongrae crane dance of local cultural heritage

Figure 1. Korean intangible cultural heritage, Crane Dance

2.3 Local cultural heritage *'Dongnae Crane Dance'*

The *'Dongnae Crane Dance'* is a traditional folk dance that was designated as Intangible Cultural Heritage No. 3 in 1972 by the city of Busan, South Korea. Since there are no written records documenting the origins of this dance, its history has been reconstructed based on the testimonies of elderly residents from the Dongnae region.[12]

The '*Dongnae Crane Dance'* originated from the festivities surrounding the traditional tug-of-war held during the first full moon of the lunar calendar (Jeongwol Daeboreum). During this event, master dancers would perform various improvised dances. According to these testimonies, it is said that

"one renowned dancer, dressed in the traditional outer robe (dopo) and wearing a black hat (gat), began dancing gracefully to the deotbaegi rhythm. Someone remarked, 'It looks like a crane dancing,' and from that moment, the dance became known as the Crane Dance. Over time, movements imitating a crane were added, and this evolved into the Dongnae Crane Dance as we know it today."[13]

The movement of the black hat and flowing white dopo robe evokes the image of a crane in flight, while the refined, elegant gestures of the dance convey the symbolic grace and nobility associated with the crane. The performance of the Dongnae Crane Dance is typically divided into six sections, featuring 16 distinct dance movements, including elements of improvisation.

In terms of costume, the dancers wear white trousers and an outer robe (*dopo*), along with white socks (*beoseon*) and traditional straw shoes (*mituri*). Additionally, a black hat is worn on the topknot and a white tassel is tied on the chest.

The accompanying musical ensemble consists of a '*kkwaenggwari*', '*jing*', four janggu (double-headed drums), and four buk (barrel drums), with vocal rhythmic chants (gu-eum) enhancing the performance.

The music for this performance consists of instruments such as the '*kkwaenggwari*' (1), '*jing*' (1), *'janggo'* (4), and *'buk'* (4), and accompanied by *'gueum'* (vocal rhythmic syllables).

03 DIGITAL TRANSFORMATION OF INTANGIBLE CULTURAL HERITAGE

Currently, the *'Dongnae Crane Dance'* since the materials only record content passed down orally, lacks a systematic framework for converting its original knowledge resources into digital form, necessitating digital transformation to develop and promote content based on cultural resources. The process of producing digital media content for the *'Dongnae Crane Dance'* involves the following steps. First, the

dance movements of Mr. Lee Seonghune, a recognized bearer of Intangible cultural heritage, are recorded using motion capture technology and systematically categorized for preservation. Second, the motion capture data is combined with VFX technology(such as 3D modeling texturing, lighting, and animation) to create a 3D character to consider historical accuracy. Third, this character is utilized to produce various digital media content. The specific production process is illustrated in Figure 2.
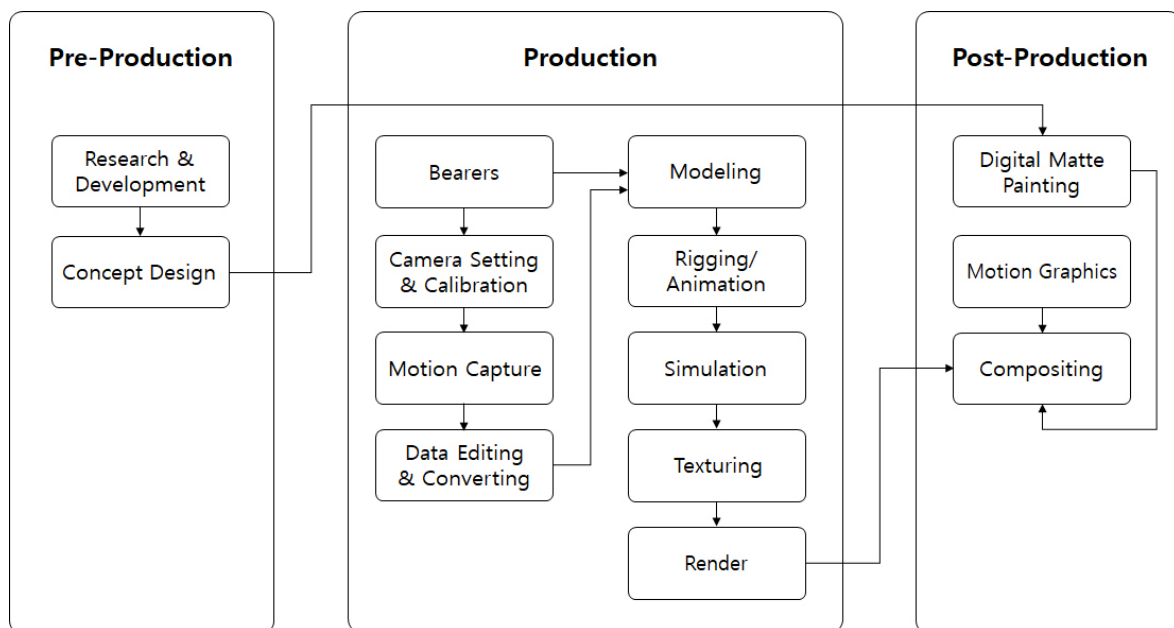

Figure 2. Digital media Content Creation Process using VFX Process

3.1 Digital Transformation of *'Dongnae Crane Dance'*

The process of digitally recording the dance movements of the *'Dongnae Crane Dance'* involves several steps. First, camera setup and calibration are performed to establish the center of the capture space. The position and orientation of the cameras are adjusted, ensuring optimal space for the subject's movements. Subsequently the dance movements of Mr. Lee Seonghune are recorded, using the OptiTrack motion capture system with 24 Primex cameras, capturing data at 180fps for approximately 13 minutes of continuous movement. The trajectory data of the performer's dance movements is then created by calculating the displacement differences from the 26 markers attached to various joints.

The initial editing of the original digital data is completed using Motive, while the secondary editing is performed using Autodesk Maya to correct any data loss or irregularities. Additionally, during the conversion process, the marker position values in the motion data are transformed into motion data with a skeletal structure. This transformed motion data is segmented by individual dance movements for systematic recording and preservation.
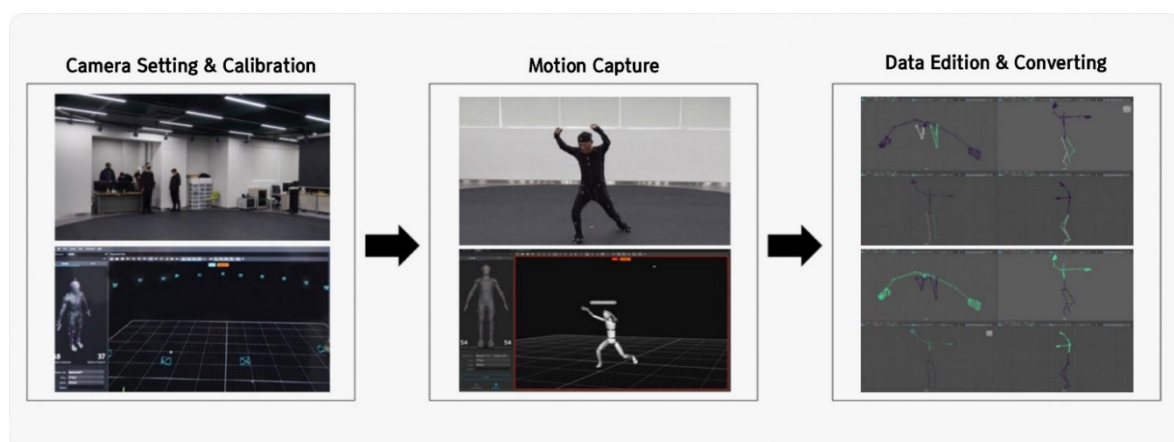

Figure 3. Dance Movement Data Extraction

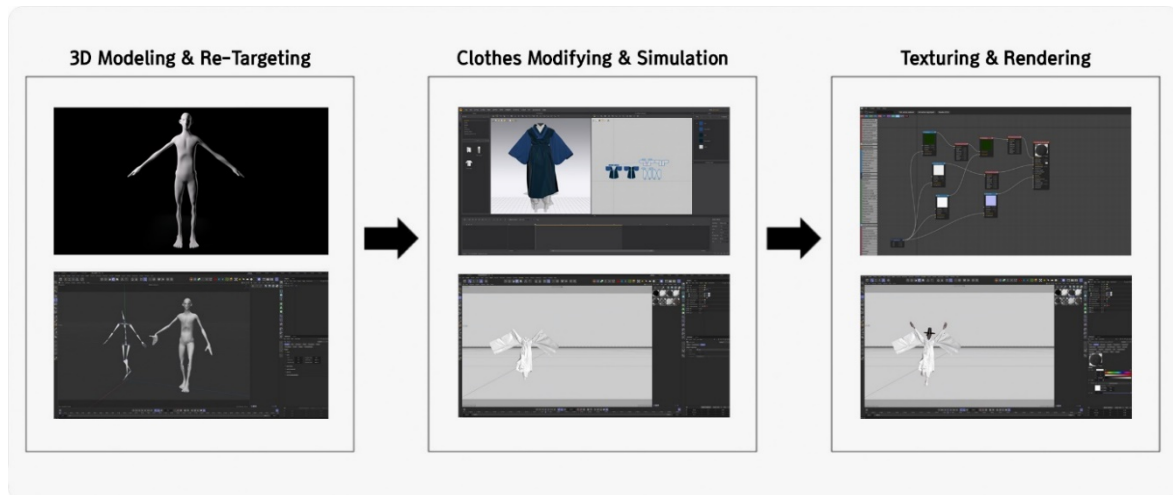## 3.2 Production of 3D Characters for '*Dongnae Crane Dance*'

*Figure 4. Re-Targeting the Motion Data from the '*Dongnae Crane Dance*' onto a 3D Character*

The process of re-targeting the motion data of the '*Dongnae Crane Dance*' to 3D characters involves several steps. This process utilizes software programs such as Blender (for frame drop), Cinema 4D (for modeling, rigging, animation, and rendering), and Marvelous Designer (for clothes modifying and simulation). First, to facilitate smooth rigging and animation, the motion data captured at 180fps is downsampled to 24fps and converted to FBX format for optimization. After completing these preliminary tasks, a 3D character is modeled with historical accuracy and the motion data is re-targeted to this character. Any errors that occur during this process, such as arm and finger distortions, are corrected through key animation. The re-targeted 3D character is then dressed in traditional Korean *hanbok*, and simulations are conducted. During this phase, errors arose due to the vigorous movements of the '*Dongnae Crane Dance*' and the flowing motion of the *hanbok*. These issues were addressed by directly modifying the skeleton of the motion data through rigging or adjusting the simulation values to ensure the '*hanbok*' moves naturally. Finally, detailed texturing is applied to the simulated 3D character, and camera and lighting setups are configured. The final rendering is completed using OctaneRender. The resulting 3D character is then utilized in the production of digital media content.

3.3 Production of Digital Media Content Utilizing Original Digital Data of '*Dongnae Crane Dance*'

The primary goal of this digital media content is to emphasize the diverse dance movements of the '*Dongnae Crane Dance*' through a short teaser trailer that employs cinematic ambiance and techniques. By stimulating the audience's curiosity, the teaser aims to generate interest and engagement with the '*Dongnae Crane Dance*'.

The dance movements of the '*Dongnae Crane Dance*' used in the production process do not depict the crane realistically ('*Moimu*'). Instead, the crane's imagery symbolically emerges from the dance itself. Among the 16 different dance movements, six that resemble the motions of a crane were selected: '*Hwalkaetjit ttwim*', symbolizing the crane's cheerful flight; '*Dolim*', mimicking a crane circling with wings fully spread as if searching for food; '*Jwawoo hwalkae*', portraying a crane joyfully fluttering in delight; *beagim,* depicting a crane leaping with wings spread wide; '*Sokuri*', showing a crane walking leisurely with its wings slightly raised; and '*Ilja*', performed with both arms fully extended to the sides. Each dance movement symbolically reflects specific crane characteristics, bringing out the essence of the crane within the dance.

In the digital media content intro, the peaks and rocks of Geumjeongsan-Mountain, a prominent mountain in Busan, are used as a backdrop to effectively depict the image of '*hanryang*' in nature. Additionally, natural elements were added to the calligraphy of '*Dongnae Crane Dance*' to make it resemble part of a mountain, and an ink wash effect was used to create an elegant and sophisticated atmosphere like a scene in a movie. (Figure 5)

Figure 5 Dance Movements of the ‘Dongnae Crane Dance’, Composed like a scene from a movie

The digital media content concept is "introducing the dance movements of the *'Dongnae Crane Dance'* while the crane fly." Specifically, "A crane flies along the mountain ranges of Geumjeongsan- Mountain. As the crane's perspective follows, the dance movements of the *'Dongnae Crane Dance'* appear over an indistinct '*hoek'*(a line or dot made with a single brush stroke). The dance movements, crane, and '*hoek'* blend with nature, and the strokes, previously seen in fragments, form into the calligraphy of *'Dongnae Crane Dance'* and disappear with the wind." The concept design is as shown in Figure 6.
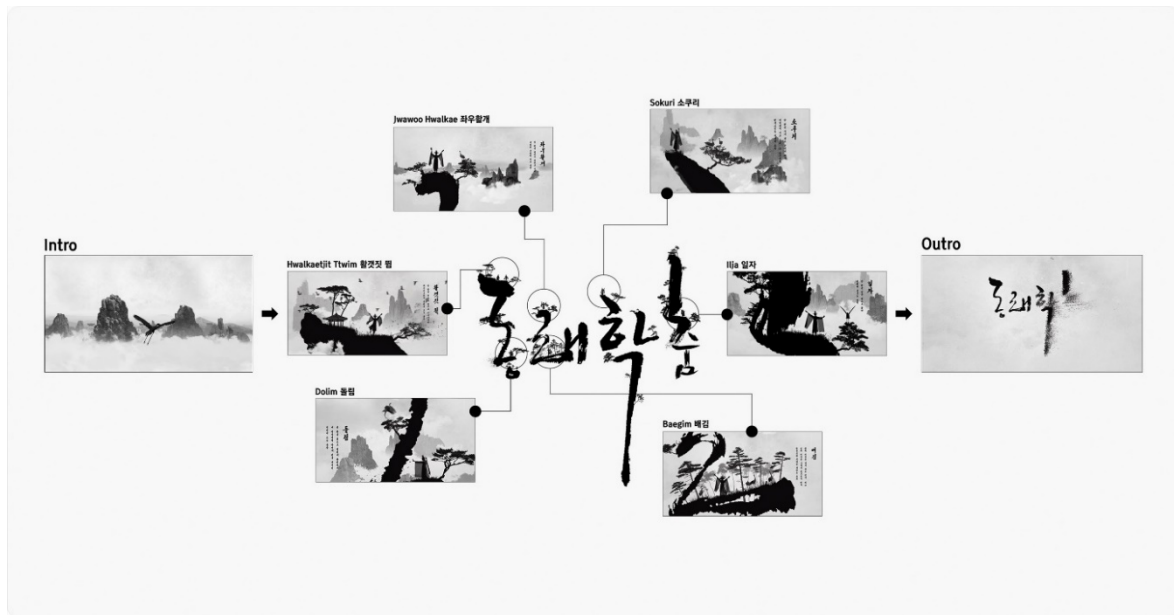
Figure 6. Digital Media Contents Concept Designed using the Calligraphy of 'Dongnae Crane Dance'

(The calligraphy for "Dongnae Crane Dance" was produced by the Busan Metropolitan City Department of Culture and Arts.)

3.4 Utilization of Digital Media Content of *'Dongnae Crane Dance'*

This digital media content was previewed at the LED Well on the 2nd floor of Dongseo University's New Millennium Digital Contents Techno Tower. While no official surveys were conducted during the screening period, several positive pieces of feedback were received. Overall, the content was praised for its sophisticated and contemporary interpretation of traditional themes, successfully blending classic elegance with modern sensibilities. Additionally, the presentation of the dance's name and style provided a deep understanding of the culture and significance of the *'Dongnae Crane Dance'*. However, there were suggestions that accurate verification of the crane's ecological characteristics is necessary, requests to enjoy various contents related to *'Dongnae Crane Dance'*.

Figure 7. *Visitors Watching 'Dongnae Crane Dance's Digital Media Contents*

4   CONCLUSION

This project successfully recorded and preserved the dance movements of ʻDongnae Crane Danceʼ by Mr. Lee Seonghune the bearer as digital data and produced it as digital media content.

The original digital data of the ʻDongnae Crane Danceʼ consists of digital motion data of the dance movements of bearer, utilizing motion capture technology, and a 3D character that can be used in various digital content. The digital media content created using these two digital resources effectively conveys the unique sentiment of the ʻDongnae Crane Danceʼ by capturing the core dance movements in a brief and intense presentation, delivering modern sensibilities and appeal.

The outcomes of the project leverage the dissemination power of digital media to enhance accessibility and re-evaluate the values of diversity and coexistence and can mark a step forward in enhancing public perception and recognition.

Future plans involve using the digital resources of the ʻDongnae Crane Danceʼ in a One Source Multi-Use (OSMU) approach to spread across various media. This strategy aims not only to preserve and reproduce the original form of the ʻDongnae Crane Danceʼ, thereby enhancing its cultural value but also to create added value in multiple areas such as regional promotion and tourism enhancement.

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