Combining the Characteristics of the Buddha Statue from Photogrammetry and 3D Creation to Simulate the Combination of the Art of Creating Buddha Statue

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***Abstract*—The creation of this research was born out of interest in creating the art of carved sandstone into Buddha statue found in the area of Phayao Province, which was part of the Lanna Kingdom that prospered during the 19th-23rd Buddhist century. In the area of Phayao province, the sandstone Buddha was created which is an art and valuable artistic feature that has been shown until now. There are five categories of sand stone Phayao Buddha style that are studied and classified which have distinctive characteristics of each Buddha statue. Nowadays, traditional techniques for making Buddha statue are becoming less and less popular as Buddha statue made of sandstone are not as popular as before. Creating a Buddha statue from stone was a difficult and laborious process. Including craftsmen in carving began to decrease in number. In this research, a tool for collecting data on Buddha statue was used photogrammetry to store and process into 3D objects and use processes and techniques for creating 3D work that has been created, and simulating the Buddha statue by using the outstanding features of the Buddha statue collected as the main part in selecting the proportion of the Buddha statue to combine to form a new Buddha statue in 3D format by simulating the Buddha statue by such methods as a prototype to reproduce the appearance of Buddha statue for use in the creation of works of art that are an important part of history. It is also used to study the characteristics of Buddha statue in combination to create the characteristics, and a new way to preserve art by using technology to transfer and preserve these valuable works of art in another way.**

Keywords*—*3D art; 3D artifacts; creation; blending art; reconstruction artifacts

I. Introduction

Creating Buddha statue data in a Phayao type Buddha statue entails using the exact qualities and structure of each portion of the Buddha statue collected to build a 3D digital file copy of the Buddha statue that references the Buddha statue's true structure. The right structure and proportions of the sandstone Buddha statue are made by the distinguishing qualities developed for imagination and visualization, which are obtained by analyzing the data from the genuine structure and proportions. The depth of Phayao craftsmen's art has condensed the incredible dimensions found in Phayao sandstone Buddha statue from the beginning through the evolution of countless forms into the unique qualities of each Phayao artisan's work. Beginning with the sandstone Buddha statues discovered in the Phayao an area, the Buddha statues are mixed with characteristics of Buddhist art from other regions of the kingdom and art by other Buddhist artists.

The Buddha statue is rather round and oval, as shown in the art of the Chiang Saen Buddha statue, which was influenced by the U-Thong Buddha statue. The two mouths of the Buddha statue that is frequently seen in the province of Phayao have a tiny and prominent nose; an oval face; a prominent nose; and a mouth with a boundary line. The researcher examined the creation of Buddha statue s by artists who make Buddha statues for temples and princes, as well as the development of Buddha statue s by local craftsmen in the region, in order to build a Buddha statue. The Buddha statues in this study are a mash-up of many types of art.

The art of sandstone carving in Phayao Buddha statue is not popular with people in today. Because the construction of Buddha statue with sandstone is a difficult process. Due to the factors of the material used to build, the weight of the stone and the procurement of stone. The factors of skilled craftsmen in stone carving are in accordance with the correct characteristics and expertise in production. In addition, the characteristics and guidelines for creating Buddha statue should be inherited and have unique prototypes. The problems and factors mentioned above are the problems that should be using digital tools and technology to assist in the creation of step-by-step and scientific and innovative tools will be used to benefit the art for the preservation and development of these values in next generation.

Instruments of technology and multimedia, such as data-collection science and computers, have been expanded and improved in a variety of ways. All suppliers are also working on new developments to make the systems more cost-effective and accurate, while also reducing current limitations. This is, to the best of our knowledge, the first study to survey various smart shelf innovations and application scenarios. [1] Even human life and activities such as living, consumption, and viewing must be integrally tied to and congruent with the technological environment. As a result, the components of the digital and technical world are astounding. Today, the world and human life are extremely important. These digitization initiatives in the human sciences prompted the cross-

disciplinary discipline of Digital Humanities to investigate computer based semantic analysis and media processing [2] Computer technology has become a new tool for modern artists in terms of art. As a result, animators can devote more energy to creative work rather than the heavy and tedious work of traditional animation [3]. These technological advances have also helped to preserve and promote art and historical understanding. The method of use is the approved recording technique that makes it easier to digitize archeological data. Photogrammetry, which is image-based, creates three-dimensional images by triangulating points (in these case pixels) and using correlation techniques to reconstruct a subject's volume. This method enables us to establish trustworthy digital archives, providing digital reproductions of the shelters and their etched panels [4].

The aim of this research was to simulate the Buddha statue 3D by combining Buddhist art with technology of computer graphic, and 3D creation. In this research will use photogrammetry and the creative process of changing the 3D model to make a 3D model of the Buddha in the style of the ancient Phayao artists. The use of these digital tools and technologies for developing and generating concepts for creating such Buddha statue is another way to develop creative forms of Buddha statues and works. The art of sculpting sandstone Buddha statues today has many problems that can be solved with digital tools. It is also another method that helps to preserve the value of art and culture for further development and dissemination. With this information, art of Buddha statue can be hacked and changed, or they can be developed digitally for research in the future.

II. Literature Review

The main of research use photogrammetry and creative process of changing the 3D model to make a 3D model of the Buddha in the style of the ancient Phayao artists. Each of them has research and creative works to guide and suggest ideas for this research. Using 3D data for reconstruct 3D shapes from point clouds, despite the fact that many point cloud-based 3D reconstruction frameworks have been proposed in recent years, we discovered that the training loss is usually Chamfer Distance (CD), which assigns equal weights to all points within the point clouds. However, for human visual perception, edges and corners are more important than flat points. According to research, the proposed framework can focus on edges/corners and produce more appealing results. The visual-enhanced approach proposed here can also be used to generate high-quality point clouds in a 3D generative model [5].

Complex deep neural networks are required to grasp and disentangle spatial transformation and image data characteristics inherent in training data in order to effectively recreate 3D images which limit the use of data-driven techniques in many practical applications. That using existing geometric information from imaging technology improves the process of unfolding incoming sensor data into 3D space in the context of computed tomography image reconstruction [6].

In the computer vision and graphic design communities, learning to create three-dimensional (3D) point clouds is becoming increasingly popular. Numerous solutions have been proposed to address the issue of producing 3D point clouds. Because a 3D object can be presented in a variety of formats, such as point cloud, voxel, mesh, and implicit field, these approaches can be classified according to their output format. As a result, manually rebuilding point clouds is the most common method of creating 3D objects. Most techniques start with an encoder that extracts a latent feature from the source images or 3D point cloud, followed by a decoder that maps the latent feature to the ground truth of the 3D point cloud [7].

Visual improvements of 3D point cloud rebuilding from a single perspective is aimed at the construction of 3D Point cloud objects, a type of 3D object creation based on object data collection that is quite common nowadays with numerous types of 3D structure processing and integration procedures involving point cloud., voxel, mesh, and implicit fields. These methods assess processes for extracting 3D structure information from entire 3D objects using point cloud-based processes [7].

The aim of the research was to develop the most effective methodology for virtual 3D reconstruction of damaged archaeological sites, which included construction or building structures, for the sake of cultural heritage conservation. Based on the revised point cloud and excluding affected areas, a surface depicting the terrain shape of the archaeological site prior to mechanical damage was interpolated. Using textured solids and surfaces representing walls, connection channels, and vaults, a rigorous virtual reconstruction of the architectural complex's original condition was carried out using both measured and interpolated surfaces. [8] The goal of this study is to recreate 3D models of ancient buildings that have been severely damaged by using high-quality map data to produce 3D skeletal structures for the preservation of history and culture [8].

In certain circumstances, digital photogrammetry and 3D reconstruction can aid archaeological excavation by reducing time without sacrificing information and even generating unique data, as well as making the site accessible to the public. Using this method, in the research aims to support studies of relative chronology based on the observation of structure textures and the statistical processing of block measurements and presents the results in the case of the St. Maria Veterana complex (Triggiano, southern Italy), a very articulate archaeological site of unknown dating, whose stratification and constructive chronological phases have been very confusing thus far. The statistical analysis of the dimensional dataset revealed indicative correlations between the various rooms of the archaeological site, and thus suggested valuable information on building techniques through comparison with results of lithological and textural observations of areas [9].

The use of photogrammetry technology creates a scalable surveying option that can be deployed faster and at a lower cost than an airplane survey. These rapidly advancing technologies open up exciting new avenues for archaeological inquiry and methodology, with the potential to reach a broader audience by engaging with topics and disciplines outside of archaeology's traditional domains [10].

The technique employed was centered on the use of point cloud 3D modeling to obtain virtual objects of a Roman cornice from the Castulo Archaeological Site (in Spain), followed by the use of those models for material restoration of the losses via 3D printing of the piece for reintegration. The process used focused on using photogrammetric 3D modeling to obtain virtual models of a Roman cornice from the Castulo Archaeological Site (in Spain), followed by the use of those models for material restoration of the losses via 3D printing of the piece for reintegration [11].

Photogrammetry procedures and processes for the digitalization and reconstruction of three-dimensional works in archaeological research and excavations can reduce study time and make knowledge accessible to the public through simulation approaches. The 3D model was created from an archaeological site in Spain using the 3D object modeling method, 3D manipulation of the specimen to generate the updated 3D structure, and 3D printing to validate the modified 3D object data [11].

With a good setup and good quality cameras with a standard lens, photogrammetry-based digitization can be a powerful tool for documenting, conserving, analyzing, and making large swaths of archaeological collections and landscapes available to the public and fellow researchers. Archaeologists and 3D specialists believe that before even taking the object out of the box, one should question their motivations for digitization and ensure the best reproduction quality possible [12].

The use of photogrammetry has aided in the virtual reconstruction of the work for the restitution of the statue, but it has also provided a useful database in 2D and 3D for the documentation of the locations. The combination of these data with historical sources improves the approach for the proposal of a scientific approach useful in restitution work, which is still hypothetical and a topic for debate in the scientific community [13]. In creating a 3D model a method of simulating a similar structure can be used to complete the construction of the object.

In fact, the use of photogrammetry allows for the creation of a detailed virtual model, which has two advantages: on the one hand, it provides valid and, above all, reliable support to historians, archaeologists, and restorers, and on the other, it allows for the dissemination of Cultural Heritage artifacts to a wider audience [14].

III. METHOD

This application, which runs on the Windows 10 operating system, allows the researcher to create and improve 3D objects. The selection of a 3D acquisition method is an important step when designing a digitization plan, and it is highly correlated with requirements such as the purpose of 3D digitization, the final use of 3D models, as well as other aspects of a digitization project such as budget, duration, and available personnel experience [15].

a) Agisoft metashape - Photogrammetry Image processing applications and tools. (see Fig. 2)

b) Autodesk maya 2020 - customization retopology process editing, and improvement tools for 3D models.

This experiment employs both surveys and creative experiments, which are data collection and processing in both the science of producing ancient Buddhist art and the creation and evaluation of multimedia technological tools.

Analysis of the different parts of Phayao Buddha art by looking at and rating the different types of sandstone Buddha statues and picking out the features that make each Buddha statue unique. Fig. 1 explains all the steps involved in the research process.

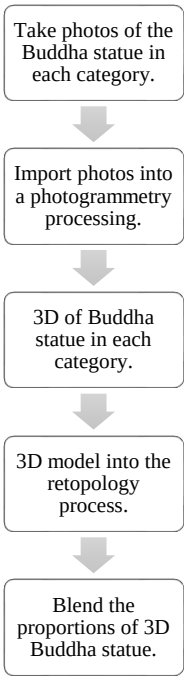

Fig. 1. Research process

1) Take a picture of the Buddha statue in each body by taking a picture around the Buddha statue . This photo recording uses the recording with the use of recording to obtain a digital image for processing. Photogrammetry is the next step. Data collection of Buddha statues digitally utilizing image processing techniques such as photogrammetry, which is a digital data recording procedure that converts images into 3D images. This will make it easier to get the desired surface proportions and surface attributes for the material.

2) Importing 3D image processing data in the form of photogrammetry. Retopology is the technique of decreasing the features of a 3D model to the lowest resolution possible while maintaining texturing and rendering equivalent to a high resolution actual image. This will make image processing in a computer program easier and faster, as well as enable the workpiece to be used in a wider range of applications, which is a crucial component in making 3D things that users of 3D tools grasp. It is important for 3D tools and applications.

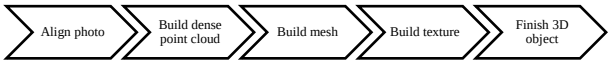

Fig. 2. Photogrammetry processing in agisoft metashape

3) But the workpiece obtained from the above process will have the same result as the real workpiece but with high polygon (high detail), making it difficult to use the 3D workpiece for editing or adjusting. Retopology is the use of the High polygon model to rearrange polygons with fewer polygons to make it easier to In order to create a new Low polygon piece from the original High polygon with the most proportions and appearance equivalent to the original workpiece, the surface treatment technique or Texture UV of the workpiece was also used. The 3D rendering is very close and looks the most similar to High polygon 3D.

4) The Buddha statue s that have been carved into exceptional proportions from the 3D models in each piece can be brought to life by choosing the proportions of the Buddha statue s that have been sketched in a rough outline before joining the Buddha statue s in the next stage.

*A*nalysis of the different parts of Phayao Buddha art by looking at and rating the different types of sandstone Buddha statue s and picking out the features that make each Buddha statue unique. Exploration of alternative means of meaning making in archaeology based on non-linear narratives, three-dimensional perspective, and virtual reconstruction is now possible thanks to 3D visualization and digital archaeological methods. [16]

5) Creating a connection between each statue by using editing software and adjusting 3D pieces by emphasizing the connection to have the least amount of adjustment because it may affect other parts of the Buddha statue and collecting details, such as adjusting and adding texture to the surface for beauty.

By evaluating the structure and proportions of the plinth elements, parts with characteristics that can be connected to each other are used. The parts of the statue will be adjusted to a minimum in order to maintain the original art that has been collected from data as much as possible.

Since then, computer technology has advanced significantly. 3D images created with the right software are truly realistic and look like photographs. They are used for popularization, education, and research. Scientists have recognized the importance of digital 3D imaging as a tool for testing hypotheses and communicating research findings to the public. [17]

IV. Analysis of Proportions and Characteristics in Assembly and Use

Characteristics of the Buddha, the Buddha statue that have been selected and used to create this Buddha statue refer to the concept of creating a new 3D Buddha statue while retaining the distinctive characteristics of Buddha statue in the Phayao art style with a combination of characteristics and widespread beliefs. Therefore, the Buddha statue proportions in the obtained Buddha statue may have different characteristics and feature combinations that are different from those commonly seen in the art of sandstone Buddha statue. But the characteristics of the proportions necessary to take into account the proportions and composition of the sandstone Buddha statue of Phayao are as follows.

1) The appearance of the head is oval, round, and flat.

2) Curved eyebrows collide into a winged shape.

3) Curved and prominent nose shape.

4) The curved mouth resembles a bird's wing.

5) Hair granules are round or square pyramidal or without hair granules.

6) The hair pacifier looks like a lotus flower which comes in both small and large sizes.

7) Body parts are plump, with large breasts protruding strongly and prominently. [18]

The above characteristics are a clear feature that will be an indicator of the creation of sandstone Buddha statue in this research process to be creative as the correct characteristics of traditional art.

V. Result

Using digital tools and methods to convey or convey the meaning of antiques and to interpret or create new ones. This is a simple and convenient method that can be extended more widely.

A touch-object, in the form of a 3D printed facial reconstruction, extends an otherwise visual experience to the visually-impaired and encourages 'embodied knowledge-making' among all visitors. [19]

The proportions and compositions of the Buddha statue s used to assemble to create a new Buddha statue in 3D are taken from the highlights of sandstone Buddha statue of Phayao that have been recorded, and study with the components shown as follows.

1) A clear base is a type of base that is extensively used in the construction of sandstone Buddha statue in Phayao. Because sandstone Buddha statues are manufactured from a single piece of sandstone, building a sandstone Buddha statue with a clean foundation is the method. Considering the techniques used by sandstone sculptors at the time, flat base styles are classified into three types: flat base, short base, tall base, and tidy hexagon base.

2) The appearance of the Buddha statue 's sitting position is a strong influence from the Chiang Saen Buddha statue , which was influenced by the sandstone Buddha statue while making the first Buddha statue in the Phayao craftsman. The diamond meditation pattern seen in the building of the Buddha statue of Chiang Saen Sing 1st Characteristics of the Buddha statue originated in Chiang Saen Kingdom which is a vast ancient kingdom in the north) and also found in the Sukhothai Kingdom art Buddha statue was used in the fabrication. It has a huge, square foot form and is the same size as the toes.

3) On a wavy crown, the head has a Buddha-shaped mouth at the margin of the mouth. The corners of both sides of the lips are swept up; the eye is bent upward to meet the mouth; and the crown is shaped like a square, comparable to a pyramid.

4) His physique is massive. His arms, influenced by the Chiang Saen Singha, 1st Buddha statue, are huge, plump, aligned, and the same size. Above the tan is a short robe (breast).

A 3D visual used in archaeology to reconstruct cultural heritage objects is a software image that reflects the knowledge gained from an analysis of archaeological excavation sources. Spatial models are built using existing documentation and literature. 3D reconstructions are created by analysing and interpreting photographs taken during excavations. [17] In Fig. 3 creating a Buddha structure by using the structure of the Buddha statue 3D from process of photogrammetry, then selecting the proportions of each part of the statue to be adjusted and corrected using the tools from the 3D program, which uses scaling to be appropriate to be able to connect seamlessly.

Fig. 3. Characteristics of the components of the Buddha statue in each part to bring together

The combination of the proportions of each piece from the 3D creation of the Buddha 3D statue from Fig. 4 in each part that creates a smooth connection and is in accordance with the typical characteristics of creating a Buddha statue carved in the Phayao style.

Fig. 4. 3D Buddha statue created by blending proportions in each art style

VI. Discussion And Conclusion

The result of the development and experimenting is a digital work in the form of a 3D piece of Buddha statue that reveals the qualities of a sandstone Buddha statue carved uniquely because the evidence and art of sandstone sculptures have degraded and cracked significantly due to both eroding material and weather. The application of such strategies or technologies to foster honesty and connect thoughts and tales from the technological process is thus extremely significant and required in the manufacturing and fabrication of components to assist in the completion and operation of this work. In this sense, the selection of qualities is critical. The Buddha statue and its dimensions should be as similar as feasible so that they can be related to each other. Too much modification in the proportions of the Buddha statue may impact the features of the Buddha statue in other proportions the fullness of the Buddha statue reproduction while applying the creative concept of the Phayao craftsman in each proportion, which is uncommon nowadays. The prospect of extending and developing the concept of Buddhist art or features from simulations, or it can be used to compare simulated Buddha statue in order to estimate the proportions of shattered Buddha statue. The use of proportions that are the overall characteristics of the unique characteristics of the sandstone Buddha statue of the ancient Phayao Buddha art statue used to assemble the Buddha statue is also the researcher's concept that brings out the outstanding features of the Buddha statue of Phayao craftsmen in each era. Assembled into a Buddha statue without finding such a Buddha statue in the creation because the development of the art of creating a Buddha statue in Phayao sandstone stopped developing the guideline, when the Lanna Kingdom and Phayao's prosperity stopped during the decline of the Lanna Empire and the city of Phayao, was abandoned. The science of developing these arts has also stopped developing. This creation is another concept that brings the remaining works of art to be applied and assembled into a new piece without destroying the original prototype. In various movements to assess the probability of previous features, research and simulation, and perfect Buddha statue or antiquities that desire to be examined and postulated in connected and associated sciences diverse works of art in other multimedia domains via the use of simulation technology. In creating a 3D model of Buddha statue, this piece helps guide the construction and production of Buddha statue or is used to create and support the creation of art to occur more conveniently from technological and multi-tools media. It also reduces problems and steps that hinder the creation and production of work pieces. It may be used to compare and evaluate Buddha statue in order to estimate and evaluate Buddha because it will disrupt the connection of the proportions of the simulated Buddha statue. According to the qualities of Buddhist art, the proportions of the presentation may not be comprehensive and attractive. However, in this creative effort, the image utilized has ties to each component of the Buddha statue. The look that was born in this exhibition demonstrates.

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