3D modeling the gamelan of saron as a documentation of cultural heritage preservation efforts

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Abstract. "3D modeling the Gamelan of Saron as a Documentation of Cultural Heritage Preservation Efforts" is a research process that aims to preserve the cultural heritage of traditional Javanese musical instruments, Saron. The results of this study are 3D Saron objects. The software used in this study is Blender 3D. In the research process, analysis of the Saron form is then made in 3D software. The research process includes analysis of the shape and layout of 7 taskbars on the gamelan board. By using multimedia developments, it is hoped that it can help preserve the regional cultural heritage. The modeling method used is polygonal modeling, primitive modeling and texturing material. The results of this study can be implemented in the future hopes in other media to form one of the 3D animations.

1. Introduction
Different cultures in Indonesia make Indonesia rich in culture. Every region in Indonesia has a whole range of different cultures and have a characteristic. Some cultures in Indonesia, which is still preserved is the art of traditional music. Traditional music is one of the cultural richness in Indonesia. One of the traditional music in Indonesia which is now still popular even abroad are the Javanese gamelan. Javanese gamelan has a uniqueness on a series of musical instruments. The majority of Javanese gamelan music instrument is a usage by struck, one of them is Saron. Saron has an important role in the series of gamelan that’s playing melodic in gamelan music [1].

Traditional music with his equipment is a cultural heritage which is certainly required an effort of maintenance and preservation of culture. As already provided for in law No. 10 Year 2010 mentioned that "cultural heritage is the cultural wealth of the nation as a form of human life and behavior that are important to the development and understanding of the history, science and culture in the life of society, nation and State so that needs to be conserved and managed appropriately through the efforts of shield cover, development, and its utilization in order to advance the national culture to the maximum the prosperity of the people” [2].

From the explanation above the author try to documentation the gamelan of saron 3D by performing 3D modeling course with supported the development and advancement of multimedia. Modeling can be done with a variety of techniques with using 3D modeling software, that’s are sculpting techniques polygonal and many more. The sculpting technique is the technique of sculpturing in 3D digital world. The purpose of this research is to know the process making of a 3D model gamelan of saron, to documentation the object using the gamelan of saron using 3D media, to implement and develop as well as add insights in the field of science information systems in particular multimedia.
2. Literature review

| No | Title | Publication & Year | Literature | Author |
|----|-------|---------------------|------------|--------|
| 1  | Rancang Bangun Aplikasi Alat Musik Kolintang menggunakan Augmented Reality berbasis Android [3] | Meylisa Rasjid, http://ejournal.unsrat.ac.id 2014 | Create Augmented Reality Kolintang on mobile android application. Kolintang as an object research. | Build 3D gamelan Saron model to keep cultural heritage preservation. Gamelan Saron as an object research. |
| 2  | Rancang Bangun Aplikasi Gamelan Gender Berbasis Android [4] | Dharma, N,S, EJournal SPEKTRUM 2015 | Create android application to play music with 2D picture | Create 3d object gamelan that can use for multipurpose like music animation. |
| 3  | Rancang Bangun Virtual Gamelan Mobile Menggunakan Augmented Reality [5] | Suryanto, T. Jurnal Dasi 2014 | Create Augmented Reality mobile android application. More gamelan object as an object research. | Build 3D gamelan Saron model to keep cultural heritage preservation. Gamelan Saron as an object research. |
| 4  | Penteksturan Model Tiga Dimensi Menggunakan Metode Procedural dan Unwrapping Material [6] | Nugraha, Bhanu Sri Jurnal Dasi 2011 | Texturing 3D model using procedural and unwrapping material method. Not specific model | Create 3d gamelan model. |
| 5  | Penteksturan Model Tiga Dimensi Menggunakan Metode Seamless Unwrapping Material [7] | Nugraha, Bhanu Sri SEMNASTEK NOMEDIA 2015 | Texturing 3D model using seamless unwrapping material method. Not specific model | Implement seamless unwrapping material method to 3d gamelan model. |

2.1. Gamelan

Gamelan is traditional Javanese music instruments are usually made of bronze, which is a mix of Tin and copper in comparison with 3:10. Because of this, a comparison of 3 'three' and 10 'ten' gamelan called gangsa. Gamelan consists of the "hard and soft" instruments. Hard instrument groups are: bonang barung, bonang kenong, panerus, kenong, kempyang, gong, kempul, demung, saron, and saron peking. While the software instruments group consists of the bag: gender barung, gender panerus, gambang, rebab, siter, slenthem, kendhang and, flute.

Gamelan instruments consists of two tone series that are the pelog and slendro tone. Pelog consists of 7 basic tone (ji, lu, ro, pat, mo, nem, tu), while the slendro consists of 5 basic (ji, ro, lu, mo, nem) [8].
2.2. Saron
Saron is a generic term for gamelan instruments who have six or seven bilahan (blades) are made of bronze or brass were laid on after the wood also serves as a resonator. Saron were beaten with hammer made from wood or buffalo horn. Based on the type and size there are three types of saron, namely: the saron barung, saron panerus and saron or peking. Saron has an important role in the play the balungan gendhing, among others, as an instrument of the voice melody.

Saron is a general term for instrument keys with six or seven keys that include an octave from the slendro or pelog series The family instruments of saron in Central Java includes several sizes, each with a different range. The key to great one-octave saron demung lower than the key size it saron barung in accordance with, which in turn, one octave lower than the saron panerus minor (also known as peking) [9].

2.3. 3D modeling
3D modeling is a process digitally engineered from original form using specialized software and represents something form the 3D object. Modeling is the process of creating a virtual form [10].

There are several things to look for in the process making of 3D models, it can affect the quality at the end result. These include methods that serves to collect data that describes the objects that will be created as well as the technical process used in the manufacture of gamelan saron 3D object.

2.4. Polygonal modeling
Polygon is the form of outer side (faces), determined by the three-dimensional points (vertices) and a straight line connecting them (edges). The region of the interior of the polygon is called faces. Vertices, edges and faces are the basic components of a polygon. When you select and modify a polygon that is using basic components [11].

Polygon is part of 3D surface which is composed of vertices, edges, and faces. A polygon can be defined as a single triangle, which further when developed and compiled all will create a 3D object.

2.5. Primitive modeling
Primitive modeling, simply combines several primitive geometric shapes (such as squares, balls, discs, etc.) and modifies their shapes to form the desired final object [12]. Primitive modeling is a polygonal modeling technique in which modeling begins with primitive geometric shapes such as cubes, spheres, cylinders, and other shapes that are then refined until the desired appearance is achieved.
2.6. Teksturing
Texturing is a technique of giving material details to an object [10]. To produce realistic three-dimensional objects, it is necessary to make appropriate textures and materials. The use of an appropriate texture pattern will have implications for object details, suitability of the model with its original shape, and memory efficiency and computer storage [12]. Using the appropriate texture pattern will affect the detail of the object and the suitability of the model with the original form [10].

3. Research methodology

3.1. Research methods
The research will be conducted using Research and Development (R & D) research method, which is a research method used to produce a particular product, then testing the effectiveness of the product [13]. The results of the research are the 3D object gamelan saron.

3.2. Data collection
Archival Method, is a method to get a data by reading or studying archives related to the problem to be solved. In this case about 3D modeling of gamelan saron.

Literature method, is data retrieval by examining theories contained in books related to the object of research, in this study include 3D modeling and gamelan saron.

Observation method, learning process and field study by observing the photo gamelan saron, observing the form of gamelan by coming to the traditional music art gallery.

3.3. Flow diagram

![Flow diagram](image_url)

Figure 3. Flow diagram.
4. Results and discussion

4.1. Saron structural analysis
Structural analysis of gamelan saron musical instruments is obtained from direct observations on saron musical instruments which aim to determine the shape of each part of saron musical instruments. From the results of the analysis obtained the design of the form of saron which will be made objects or 3D models using Blender software. The following is a plan for the structure of the gamelan saron:

![Figure 4. Saron structure.]

In analyzing the structure of the saron gamelan, the author gives a name to each gamelan saron blade which aims to facilitate the making of 3D models on each blade.

4.2. Modeling step
In the modeling process the gamelan structure is divided into two stages, the first stage is the gamelan blade modeling process. Modeling using a basic cube, then proceed with modifying the face, vertices and edge according to the reference form from the structural analysis of the saron gamelan blade. Besides based on structural analysis, modeling is carried out based on the results of field studies that have been carried out.

![Figure 5. Blade of saron.]

The modeling process of 7 gamelan blades can only make one basic model which can then be duplicated one by one, then the size of each gamelan blade is adjusted according to the structure of the analysis, so
that it can simplify the modeling process, this is done because the shape of the saron gamelan blades are relatively the same but the size of each blade different.

The second stage modeling is the board modeling, the board serves as a place where 7 blades of gamelan saron are placed. In the process of modeling the board still uses the basic cube on Blender software.

![Figure 7. Board saron modeling process.](image)

### 4.3. Texturing

In this research two types of texturing were carried out namely procedural texturing and file texturing. Procedural texturing can be done by using the default blender software feature. Procedural texturing is given to the object of the gamelan blade, this is done because the gamelan bar is originally made of metal so it does not require special texture. While the file texturing is given on the board, because the original board is made from wood and the majority of the board has a traditional texture to add an artistic impression to the saron gamelan.

Files texturing need image files that were previously created using other software, Adobe Photoshop as in Figure 7, then the size is adjusted to the 3D board model that has been created. Modeller can be creative as needed from outside the blender software feature.

![Figure 8. File texturing process.](image)
4.4. Rendering, uploading
The last stage of 3D gamelan saron modeling is rendering and uploading that aims to process the publication. In this step, the author using Sketchfab.com to process online publishing of 3D gamelan saron object because there are various features and visitors to be able to explore 3D objects for free.

![Image of Sketchfab.com](image)

**Figure 9.** Publication process on sketchfab.com.

4.5. Product similarity test
Product testing is done by asking several questions to 10 respondents. In this research, questions were asked regarding the level of similarity in 3D gamelan saron and the realistic level of 3D gamelan saron to the original gamelan.

The questions asked are as follows:
- Is the structure the gamelan saron is same with its original form.
- Does the saron gamelan texture look realistic.

| No | Respondents  | Question 1 | Question 2 |
|----|--------------|------------|------------|
|    |              | SA A DA    | SA A DA    |
| 1  | Respondent 1 | ✓          | ✓          |
| 2  | Respondent 2 | ✓          | ✓          |
| 3  | Respondent 3 | ✓          | ✓          |
| 4  | Respondent 4 | ✓          | ✓          |
| 5  | Respondent 5 | ✓          | ✓          |
| 6  | Respondent 6 | ✓          | ✓          |
| 7  | Respondent 7 | ✓          | ✓          |
| 8  | Respondent 8 | ✓          | ✓          |
| 9  | Respondent 8 | ✓          | ✓          |
| 10 | Respondent 10| ✓          | ✓          |
|    | COUNT        | 5 5 - 1    | 9 -        |

From the questions posed to the respondents, the authors concluded the assessment as follows:
- Structure the 3D gamelan saron is same with the original form.
- The gamelan saron texture is close to realistic.
5. Conclusion
From the similarity test result of 3D gamelan saron products, the structure of the 3D gamelan saron is same with the original form. With procedural texturing on the 3D gamelan saron blade can give a metal effect so that the internal features of the blender software can be used in 3D gamelan saron modeling.

6. Suggestion
This beginning research is less than perfect, so that a number of new studies are needed for improvement, such as in the file texturing section to create a realistic model. Increase the number of vertex, edge and face to be able to increase detail levels and smoothness levels of gamelan saron 3D model. As well as modeling on other gamelan objects because there are still many types of gamelan instruments besides saron.

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