Preserving Malay Architectural Heritage through Virtual Reconstruction

Nazrita Ibrahim

College of Information Technology
Universiti Tenaga Nasional
Selangor, Malaysia
nazrita@uniten.edu.my

Khairul Azhar Azmi

Faculty of Multimedia
Kolej Universiti Insaniah
Kedah, Malaysia

Abstract - **Preserving architectural heritage is a challenging and costly task. Digital preservation helps to both reduce costs and make it portable. This paper describes our experience in producing a 3D model of Rumah Tok Su; which is a traditional Malay house, situated in Kedah, Malaysia. The aim of this project is to capture the essence of architectural heritage via still images that are rendered to highlight its beauty and significance.**

Keywords - Virtual heritaget; Cultural heritage; Architectural heritage; Traditional malay house

I. INTRODUCTION

A traditional Malay house is an example of architectural heritage that belongs to the Malays; one of the many ethnic groups residing in Malaysia. The Malays designed and built their houses according to their needs, and with a good understanding of nature and the environment, they incorporated and reflected their way of life and culture. However, these beautiful traditional houses are fast becoming extinct, due to the current generation of Malays embracing a modern lifestyle and modern house forms. This has resulted in a lack of interest and appreciation of traditional Malay houses by the younger generation. Furthermore, maintaining or building new traditional Malay houses can be expensive; largely due to the high price of the timber used in their construction, and the scarcity of *tukang* (skilled carpenters); who have the knowledge and expertise to build these houses.

Efforts have been made to preserve the houses that still exist. Some have been disassembled and re-assembled again in other locations, such as museums or heritage centre compounds. However, with the advancement of information technology, the preservation of this architectural heritage can be achieved by recreating these buildings in a 3D form; as done by many other researchers in this field [1-4]. There are many benefits in having these houses preserved (recreated) in a 3D form. One of which is that we can place these 3D models online, so that people all over the world can have access to them. Since traditional Malay houses contain complex architecture details, such as *kerawang* (decorative carvings used for ventilation purposes, and to allow just enough light to enter the house during the day - as shown in Fig. 1), or construction techniques, such as *tanggam* (a technique used to join parts of the house - as shown in Fig. 2), we can also have

the 3D forms as a blueprint to capture these unique construction techniques and preserve this architectural knowledge for the benefit of future generations.
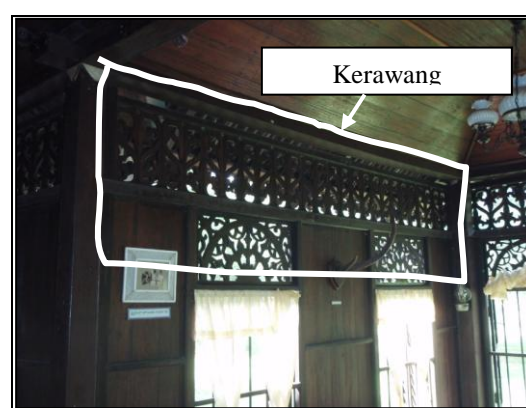

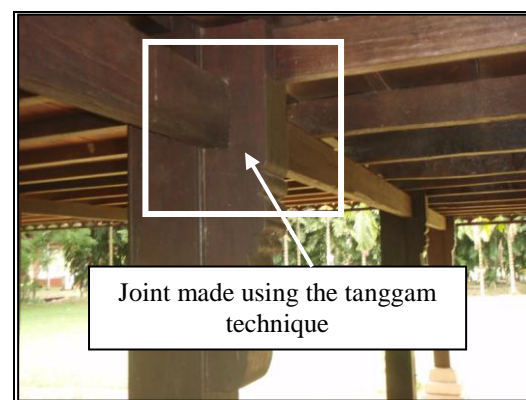Fig. 1 Kerawang (or decorative carving) found in traditional Malay houses

Fig. 2 Tanggam (a technique used to join parts of the house without nails).

Rumah Tok Su is a traditional Malay house situated in Alor Setar, Kedah. The house was relocated from its original place, Bandar Baharu, approximately 200 kilometres from Alor Setar [5]. Rumah Tok Su was chosen to be recreated in a 3D form, because the house is still in a good condition (Fig. 3) and contains many beautiful and important architectural features that deserve preservation. For example, Fig. 4 shows some of the beautiful decorative carving found in the *anjung*

area of the house. *Anjung* is a covered porch, located at the front of the house, which is used to greet guests and also serves as a favorite place for the occupants to spend their leisure time; resting or chatting about life with passers-by [6].

Fig. 3 Rumah Tok Su - currently being relocated to Alor Setar, Kedah.

Fig. 4 Some of the beautiful carvings of Rumah Tok Su.

This paper describes our attempt to recreate Rumah Tok Su, a traditional Malay house situated in Kedah, Malaysia, as part of our effort to preserve this valuable Malay architectural heritage.

II. FROM DOCUMENTATION TO DIGITIZATION

A. Documentation Strategy

Since we would like to show the different aspects of a traditional Malay house in a 3D model, it is important for us to document every single construction feature of the house. Given that the design of each traditional Malay house is unique, we measured the house (both inside and outside) manually. Measuring the house manually also gave us the opportunity to observe (and critically analyse) the house's architectural details. For example, Fig. 5 shows the walls of Rumah Tok Su, which consists of a frame and wall covering. By measuring manually, we were able to recreate the house's entire wall framing system (as shown in Fig. 6), and the wall covering (as shown in Fig. 7).
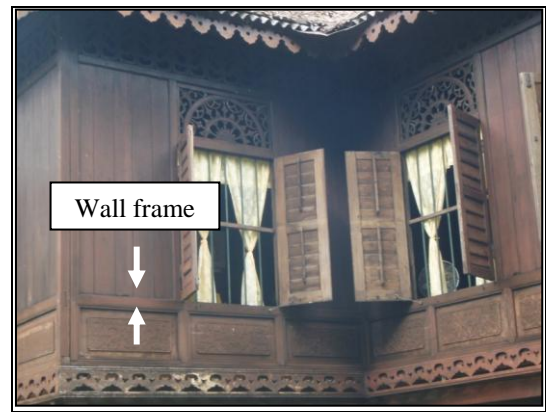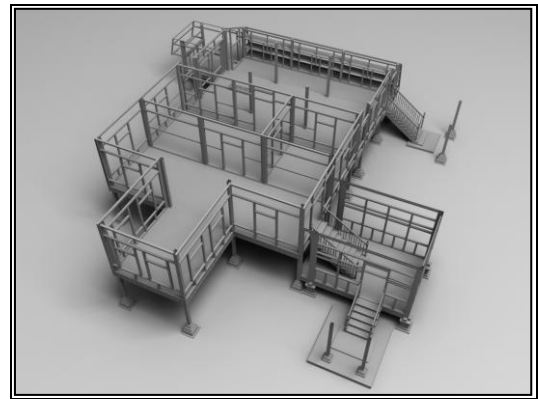

Fig. 5 The wall frame of Rumah Tok Su

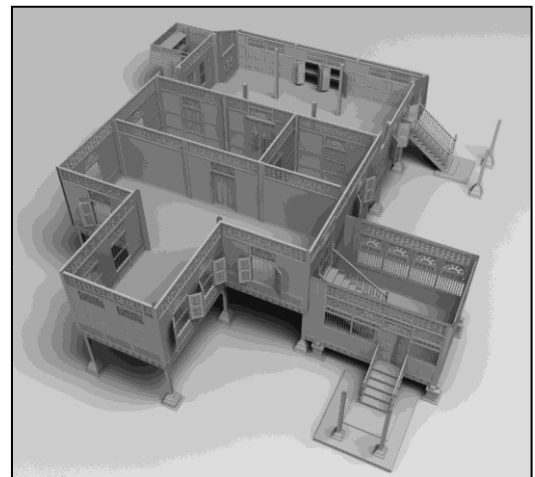Fig. 6 The wall frame being created in the 3D model

Fig. 7 The entire wall covering of Rumah Tok Su

B. 3D Modeling Strategy

We modelled the house with the intention of recreating it with the finest detail. We used polygonal geometry to build the model; using primitive shapes as basic shapes to model the house. We removed unnecessary faces to decrease the polygon count and to reduce the time needed during the rendering phase [7].

C. Issues and Challenges

There were two issues that needed to be addressed during this project. First, since the house did not have a blueprint, we had difficulty measuring parts of the house that were inaccessible or hidden from view. To solve this problem, we looked at different houses with similar architectural features, and used their design of that feature as a reference. In this project, the roof frame structure of Rumah Tok Su was inaccessible, because it was covered by a timber ceiling (see Fig. 8). However, because we knew that the house bears the design of what the Malays call *Bumbung Limas Potongan Belanda*, we were able to refer to another house with a similar roof structure, as a guideline for us to reconstruct the roof of Rumah Tok Su (see Fig. 9).
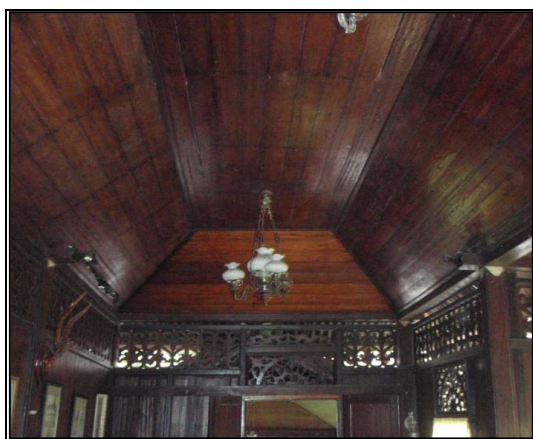

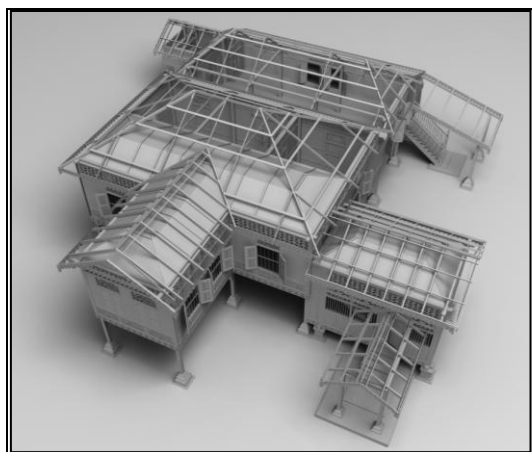Fig. 8 The ceiling obscured our view of the roof frame

Fig. 9 The roof frame created in the 3D model

Second, the modelling of the *kerawang* (decorative carving) was the most challenging task. 'Kerawang tebuk' (example shown in Fig. 10) was easier to create, because we simply cut or removed unnecessary surfaces to create holes, and used the extrude function to create the different protruding levels of the surface. However, 'kerawang timbul' (example shown in Fig. 11) required us to use the line drawing tool to draw the outline of each of the decorative shapes that made up the kerawang. Then we adjusted the height of the surface

(using the extrude function) to create different levels of the protruding surface (example shown in Fig. 12).
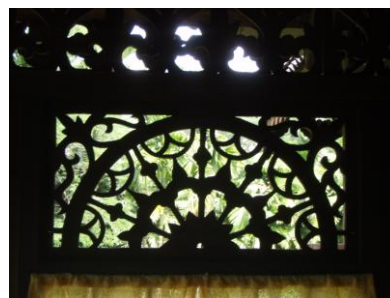

Fig. 10 Kerawang Tebuk
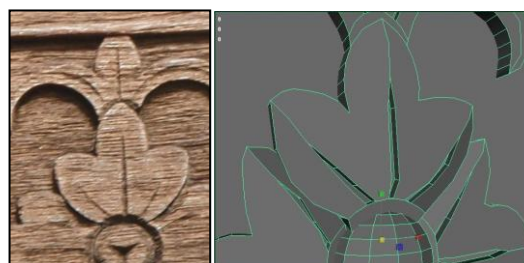

Fig. 11 Kerawang Timbul

Fig. 12 Adjusting the protruding level of each of the decorative shape

III. OUTPUT OF THE VIRTUAL CONSTRUCTION

The main output of this project is a comprehensively created 3D model that captures all of the important features of a traditional Malay house. We decided to not apply a texture to the 3D model. We rendered the 3D model in a grey tone; since we wanted to highlight the beauty of the architectural details; which we believe is better captured without texture. Fig. 13 shows a front view of the rendered Rumah Tok Su 3D model, while Fig. 14 shows a snapshot of the back of the house. Both Fig. 15 and Fig. 16 show beautifully rendered images of some of the many kerawang found in Rumah Tok Su.

Fig. 13 The 3D model of Rumah Tok Su

Fig. 14 Rear view of the house.

Fig. 15 Kerawang, or beautiful decorative carvings, found in *Anjung*.

Fig. 16 Another beautiful carving found in Rumah Tok Su, combination of kerawang tebuk and kerawang timbul.

IV. CONCLUSION

Preserving architectural heritage is important for the benefit of future generations. In this paper, we presented our experience in recreating a 3D model of Rumah Tok Su, which captured all of its important architectural features.

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