Promoting Traditional Javanese Architecture Using Architrad Software

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Abstract

Traditional Javanese architecture consists of four big categories; they are buildings for commoners, for noblemen, for the king, and for worshippers. Each category has several variants of roof, each of which was named uniquely. There are *omah kampung* roofs for commoners, *limasan* roofs for noblemen, *joglo* roofs for the king as well as *tajug* roofs for mosque-goers. These variants were recorded, grouped, and arranged in a single software with Visual Basic program named Architrad. It is designed to promote the richness of traditional Javanese architecture to the world and to help researchers in the field of architecture obtain detailed information regarding traditional Javanese architecture. Methods of the research were collecting all variants of traditional Javanese architecture, which were documented further and made into simple working drawings. They were classified and put together in Visual Basic software application. The results showed a complete digital library of traditional Javanese architecture packed in a software named Architrad.

Keywords: Traditional Architecture, Javanese Architecture, roof design, Architrad software, digital library

INTRODUCTION

Traditional Javanese buildings are known for having the most roof variants among other traditional buildings in Indonesia (Prijotomo, J., 1984). These roof variants enrich the repertoire of architecture in Indonesia. However, not many people understand their principles of construction. Often times such principles are put aside when doing modification for modern buildings, making the roof not sturdy enough (Santoso, M. & Krisnany, M., 2004). Besides, the heat inside the roof loft cannot to be properly distributed and optimally reduced. Heat will creep down the rooms beneath as a consequence (Purwanto, L.M.F., 2017). Buildings will become a lot less convenient to live in. Meanwhile, traditional Javanese buildings are eco-friendly and have stood the test of time. However, when the principles of Javanese house construction are applied in modern Javanese houses, they are less effective. This is due to the fact that more modern Javanese houses because they do not conform to the principles of traditional houses building construction (Rianingrum, C.J. et al., 2015).

This research aims to unveil and resolve problems related to construction errors and the traditional house construction system. The results are compilations of traditional Javanese building roof variants which include the information of thermal and construction strength, as well as the reviews of the philosophy behind each Javanese building roof form. They can be used as references on the application of modern building designs for architecture students, academic practitioners, and public. The results are also packed in a simulation software to make it more attractive and understandable.

BASIC THEORY

a. Review of Literature

Reviews of diversified Javanese architecture are explained in great details in Prijotomo (1984)'s book. In his book, Prijotomo revealed the ideas behind traditional Javanese building forms and variants. A similar book that discloses the variant form of *Joglo* house was written by Ismunandar, K.R. (1990). Pictures are shown in the forms of sketch and floor plans. Ronald, A. (2005) analyzed the concept, the construction methods, and the appearance of the traditional Javanese houses. He presented the traditional Javanese architecture, the transformation of the mystical symbolic values of such expressions as well as the preservation of the environment of traditional Javanese houses.

Many traditional Javanese buildings are getting damaged and can hardly be renovated. Damages are often resulted from aging, pests or earthquake. Utomo, G.S.W.P. (2014) wrote about the damaged traditional buildings in Yogyakarta due to the earthquake in his dissertation.

This research was conducted by documenting the traditional Javanese buildings with attractive layouts as seen in the Architrad software. Pictures, images and descriptions of all traditional building types are included in their layout to enhance their attractiveness. Pictures of heat transfer obtained from this research are also added. Hence, Architrad contains a complete database of traditional Javanese building information. Readers can easily browse on this Visual Basic-based software to find out more information related to Javanese architecture building with just one click.
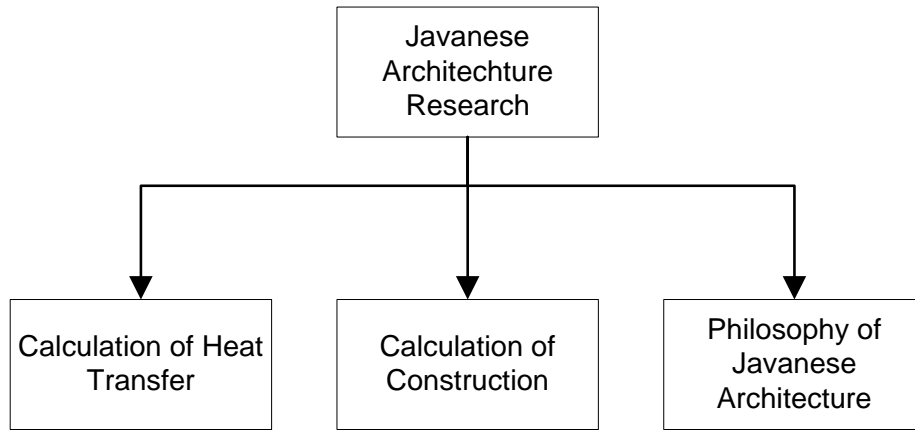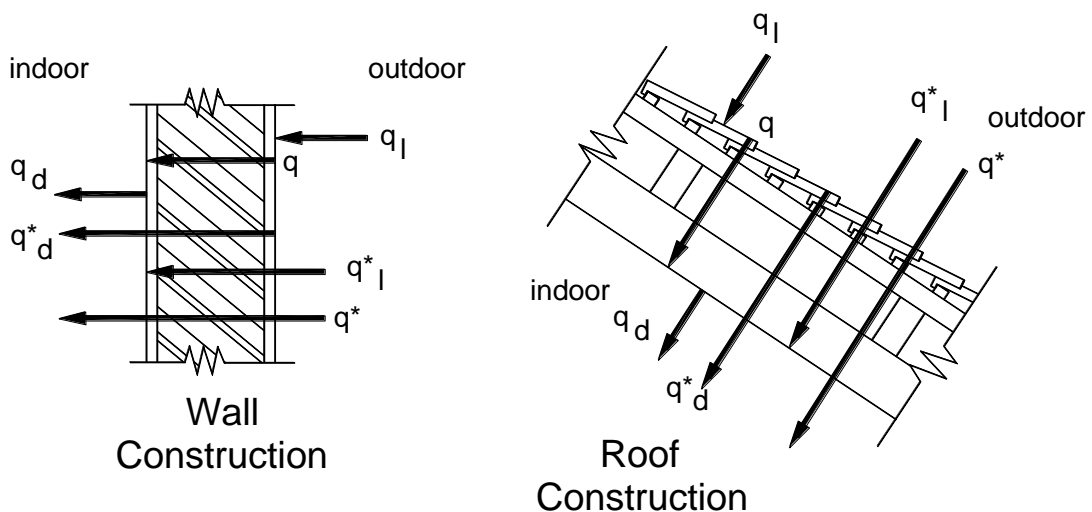
Figure 1. Theoretical framework

Figure 2. Heat transfer

b. Theoritical Framework

The theoretical framework in this study uses the following approaches (Figure 1):

Heat transfer equation is done by calculating the heat transfer on walls and roofs (Mehra, S.R., 1998). For surface resistance $(1/\alpha)$, a general benchmark uses the following calculation:

Outdoor surface resistance : $1/\alpha_l = 0,04$ m² K/W

Indoor surface resistance : $1/\alpha_d = 0,13$ m² K/W

The following procedure is used to measure the wall surface temperature and the temperature in the roof loft. The calculation of heat transfer rate (q) is required to measure the temperature of roof surface and walls surface. The approach shown in Figure 2 indicates the influence on every part of the building and the calculation of each heat transmission.

Which:

$$q_d = q_l = q \qquad [W/m^2]$$

$$q_l = \frac{(\vartheta_{ul} - \vartheta_{pl})}{1/\alpha_l} \qquad [W/m^2]$$

Another component needed to calculate the heat transfer rate is the measurement of object resistance $(1/\Lambda)$:

$$\frac{1}{\Lambda} = \frac{s}{\lambda} \ [\ m^2K/W \ ]$$

Note: s = object thickness [m] and λ = thermal conductivity of building materials

Traditional building construction is calculated using mechanical engineering calculation approach, with calculation support reaction need to be resolved before moment calculation (Purwanto, L.M.F. % Darmawan, A.M.S., 2009).

Mechanical engineering calculation approach is always measured by moment calculation, in that moment equals to Force times Distance, where distance is **perpendicular** to force as shown in Figure 3.

In mechanical engineering, moment is depicted in a graph to make it easier to detect. It is also used to calculate moments which are way too big in number. For such moments, specific treatments and stronger construction are required. Moments are classified into two. The first one is moment on concentrated loads and that with uniformly-distributed loads as shown in Figure 4.
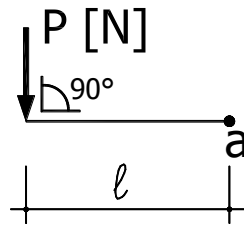
Figure 3. The principle of moment calculation, which P=Forceand ℓ= distance
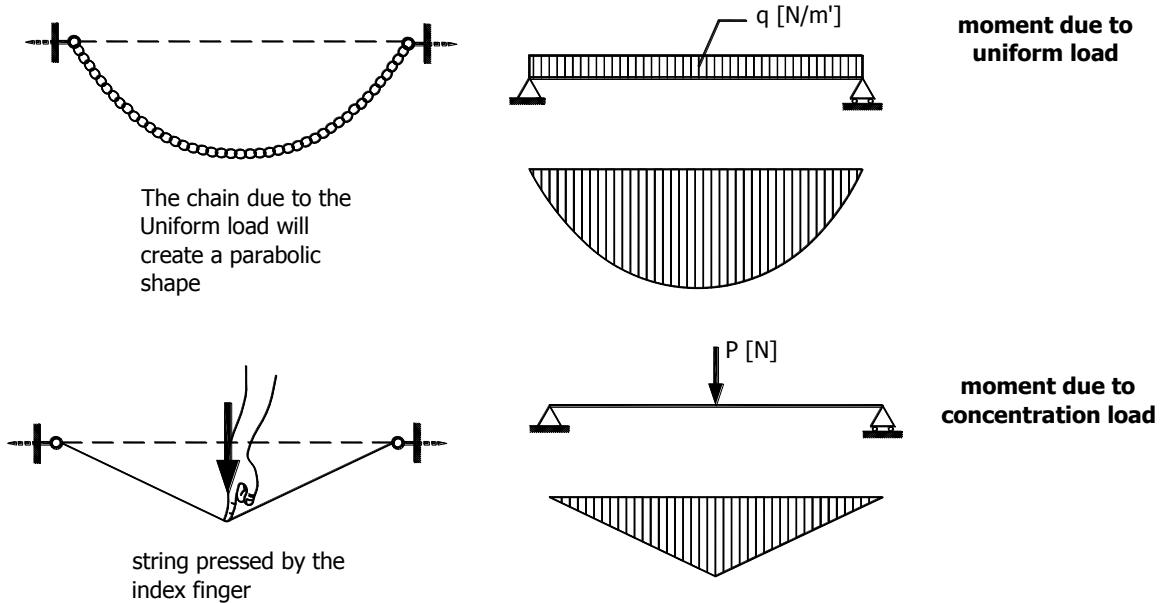
Figure 4. Moments at concentrated loads at the center and uniformly-distributed loads

The calculation of moment will provide information of the strength of the building construction and weak spots in a block. Strengths and weaknesses of a building construction have to be identified and calculated from the beginning.

The study of construction, heat transfer and images of each traditional Javanese building form are archived in each data folder.

Smaller data can actually tracked down manually. However, data with bigger numbers and more variants can be optionally displayed from a data processing program to enhance attractiveness. Visual Basic becomes a suitable software for this option (Taha, M. & Saad Fadhil, 2010). Database

processing in Visual Basic can be performed through various methods as follows:

- One-to-many relationship
- Many-to-many relationship
- One-to-one relationship

METHOD

Traditional Javanese buildings in Central Java were recorded and documented in the form of photography, sketch and floor plans using AutoCad software. The images were processed

and developed using 3D simulation with 3D-Max software in order to produce animated images of object rotation. Therefore, the image could show how the building looks from all directions. After that, an analysis was conducted on the building strength and roof thermal condition due to solar radiation that penetrates it, which was shown as 2D on the traditional Javanese buildings. Once the analysis was done, the results were exhibited in the form of digital library in the Visual Basic-based software. The layout becomes more attractive, communicative, and readable for general readers.

DISCUSSION

The process of making Visual Basic-based Architrad software was initiated with arranging a flowchart to enhance acurateness and hit the spot.
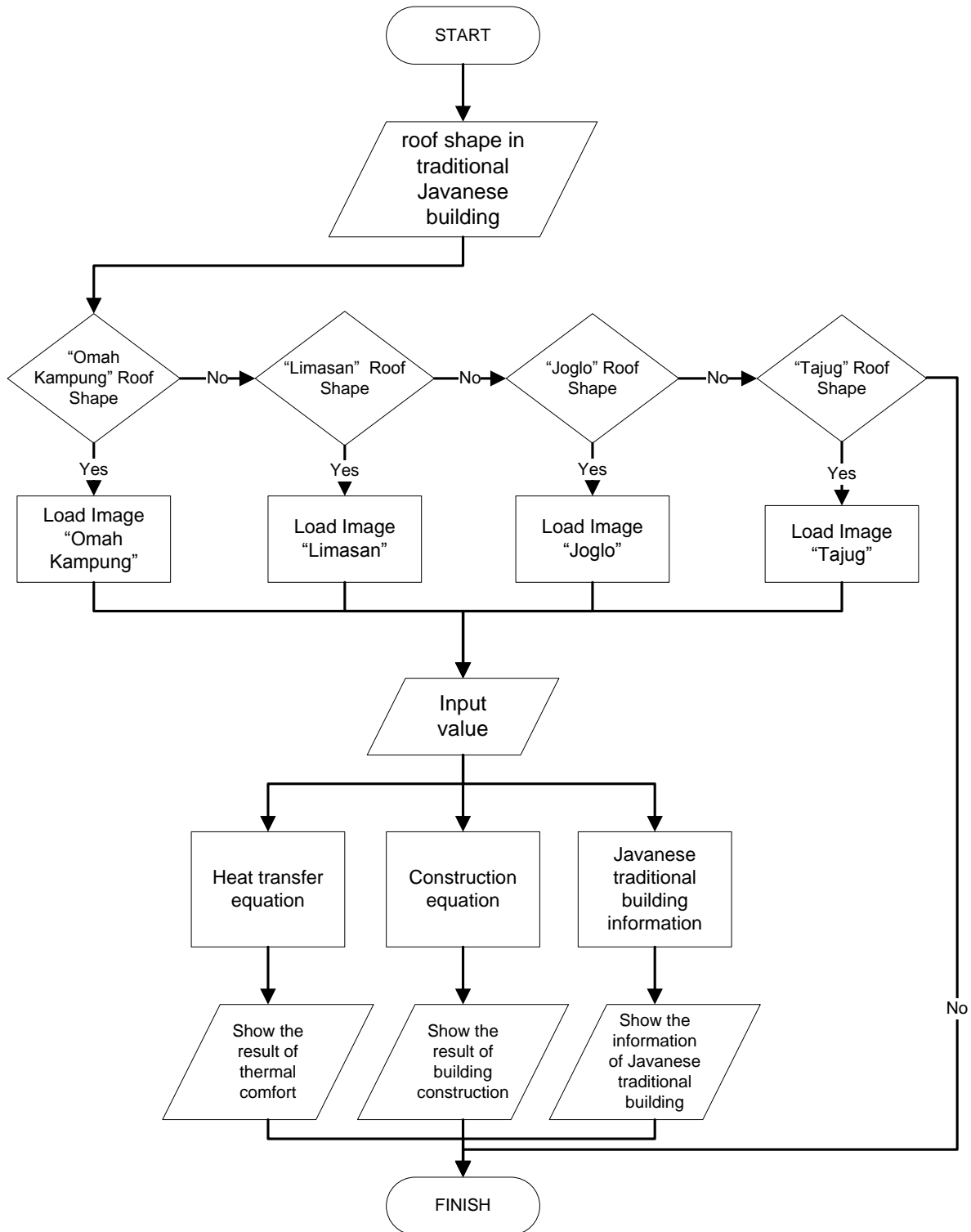

Figure 5. Flowchart of making Architrad software

The preview lists the developers of this software and displays introduction about it.

Figure 6. The front layout of Architrad software

Users are introduced to Javanese architecture with simple and comprehensible reviews. Afterwards, they can proceed to a page displaying options for each traditional Javanese building type. When clicking on the selected traditional Javanese building, more options will be showed to read the information on the building strength, heat transfer, as well as pictures and reviews related.
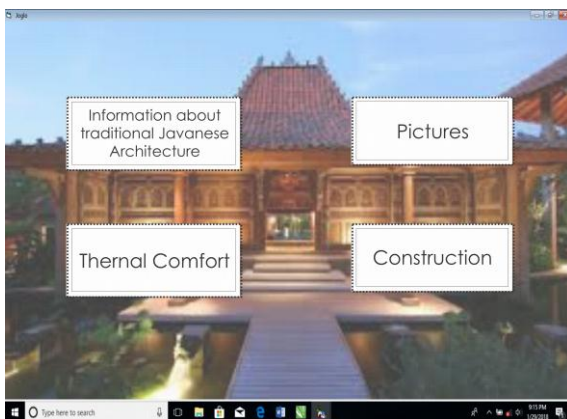

Figure 7. The interface layout of Architrad software

This layout had been tested by several Architecture students. The result showed that Architrad's operation system is user-friendly. In accordance with Zhao Chen and Huang Fang (2013), the use of Visual Basic-based application is highly feasible for classroom lessons and compherensible for the students.

CONCLUSION

Architrad software is developed with Visual Basic as the basic software. It has accessible features which can be easily displayed for the users. A complete database of Javanese architectural types can be found in a single software, including construction understanding and details of thermal comfort.

Visual Basic enables one to operate every interface easily as a piece of information from each Javanese traditional building type.

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