THE LEGACY OF COLONIAL BUILDINGS IN KHULNA CITY - AN APPROACH TO DIGITAL DOCUMENTATION

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ABSTRACT:

Khulna city was established during the British colonial period as a sub divisional centre in 1842. The city is characterized by a number of colonial buildings scattered all over the city area. For the last hundreds of years these beautiful buildings with their distinct aesthetic value were acted as the source of inspiration of new development, as well as building city image. But, once these magnificent pieces of buildings enrich the beauty and glory of Khulna city are now facing severe pressure in keeping existence due to rapid urban development.

On the other hand, Department of Archaeology of Bangladesh is mostly interested on built-heritage of national interest and merely on colonial artefacts. The problems associated with such job is, it needs time, money and expertise. As it is the reality, that we are unable to preserve physically most of our valuable artefacts – digital preservation may be one potential solution. Keeping this fact in mind we have identified more than more than two hundreds potential colonial buildings and made an attempt to digitally document them. In first step by defining the exiting typology twenty buildings have been selected and documented in detail with CAD drawings and photographs. In second step, 3D rendered models of some artefacts have been developed. The study has found; excluding the initial investment the overall financial expenses is quite affordable. Author hopes this study can be used as an example for digitally preserve and documenting other colonial buildings in Bangladesh.

1. INTRODUCTION

1.1 Background

'Khulna' city was established during the British colonial period as a sub divisional centre in 1842. Khulna was declared as municipal town in 1884 and the next year Kolkata-Jessore railway was extended to Khulna. Railway station was setup in 1904, which was a major attribute for growth of Khulna (Ahmed 1984). Since then, the actual growth of the town became evident. This was expedited by development of communication with other parts of the province by rail and steamer services that were already established. River became the all-important route of transport for this coastal town, which enhanced the importance of riverfront as probable setting for the new buildings that followed afterwards. Parallel to the riverbank came up administrative and civil buildings, the characteristics of which are spacious setting and an image of prominence. In the inner area away from the river and parallel to the alignment of buildings a metal road (now called K.D.Gosh Road) was built. As the pressure mounted the building projects were carried out on the other side of this road. Eventually by the turn of the century, this whole area along the Lower Jessore Road became the administrative entity, the civil line of the British Raj (Mridha & Khan 2002).

On the other hand, artefacts of private nature are scattered all over the city area. For the last hundreds of years these beautiful buildings with their distinct aesthetic value were acted as the source of inspiration of new development, as well as building city image. But, once these magnificent pieces of buildings enrich the beauty and glory of Khulna city are now facing severe pressure of rapid urban development. Increases of need and rapid changes of use pattern are forcing new developments to invade these beautiful artefacts by completely replacing or altering the existing structures.

Figure 1: Marine Associate Building (demolished in 1999)

Figure 2: Nagar Bhaban (demolished in 2003)

Keeping this fact in mind we have identified more than more than two hundreds potential colonial buildings and made an attempt of digital-documentation through a low-cost approach. In first step by defining the exiting typology twenty buildings have been selected and documented in detail with CAD drawings and photographs. In second step, 3D rendered models of some artefacts have been developed. The study has found excluding the initial investment the overall financial expenses are quite affordable. The study aims to digitally preserve all those two hundreds buildings and publish them on web in future.

1.2 Objective

With limited manpower and resources the Department of Archaeology of Bangladesh (the authority that is responsible for conservation and documenting the past heritage) is mostly interested on built-heritage of national interest and merely on colonial buildings. Even these colonial buildings always attain public sympathy, the problems associated with such conservation job are, it needs time, money and expertise. Moreover it is also quite difficult for a government like Bangladesh to preserve such a big amount of artefacts scattered all over the country due to financial constrain. As it is the reality, that we are unable to preserve physically most of our valuable artefacts – digital preservation may be one potential solution. Keeping in mind the constrain of economic support and lack of expertise, this paper has tried to explore a cost effective solution for digitally preserve some colonial artefacts of Khulna city.

1.3 Methodology

Once a treasure is lost, so is lost the chance to study, analyze, or simply appreciate its impact on society. Through digital means, however, culturally significant sites can be documented and preserved by committing them to computer memory. Thus these wonders of the past can be enjoyed by present and future generations. Recently developed different techniques of 'Digital documentation' by means of 2D CAD drawing and 3D virtual model building technology through image-based modelling, 3D scanning, image-based rendering etc. have expanded the possibilities to virtually re-create antiquities and buildings. Digital tools and techniques now emerging from academic, government and industry labs offer new hope to the often painstakingly complex tasks of archaeology, surveying, historic research, conservation and education (Addison 2000). Even these technologies are widely accepted and practiced for virtual reproduction of built heritage and archaeological sites, such attempts have seldom tried in Bangladesh.

The study followed the following steps:

- In first step we have identified more than two hundred potential colonial buildings within Khulna city and studied their typology according to its patronization and use.

- In second step, existing technologies have been studied and the most available, effective and economic one is selected.

- To develop a comprehensive digital database, in third step twenty buildings have been selected from different typologies and an extensive photographic survey has conducted to ensure enough information to support 2D CAD drawings.
- In fourth step, digital drawings of selected buildings have been prepared through physical survey with photographic aid.

- Finally, 3D rendered models of some artefacts have been developed by using free software to understand the total procedure and related expenses of the digitalizing process.

2. DOCUMENTATION

2.1 Identifying building typologies

"With the British assuming political power in about 1757, architecture acquired a new dimension. Monuments with purely a European renaissance style appeared, initially in the British churches of Dhaka and few other outlying areas. Subsequently this style was applied to secular buildings, of which remains may still be seen in the Wiseghat locality in old Dhaka, and in Khulna district." – Nazimuddin Ahmed (Ahmed, 1984).

Colonial artefacts in this region are basically product of two totally different cultures, the first the Indian, originally a mixture of Muslim and Hindu, the second the colonial form of a European and particularly British culture (Mridha & Khan 2002). The earlier, 19th century colonial urban settlement of Khulna was predominantly the civil lines. This was and largely still is an area of very low residential density, originally planned and built according to the values of the metropolitan society as interpreted by and for the use of a colonial culture. The residential section consists of European norms with spacious bungalows within large compounds. A large proportion of visual, symbolic or ceremonial space is incorporated in the layout. Roads designed for motorized elite rather than a pedestrian mass are broad and long; in contrast to the indigenous city. Climatic control is attained by extensive tree planting, illustrating a basic preference of the colonial culture.

After identifying more than two hundred buildings around the city, a broad category has been made based on the nature of their patron and use. The following figure-3 illustrates the typology of artefacts during the colonial period in Khulna city.
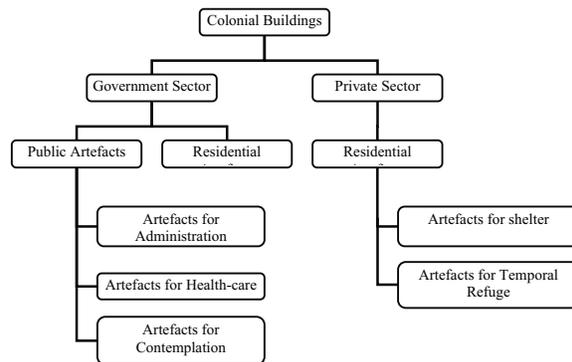

Figure 3: Artefacts typology according to patronization and use

This study has tried to select samples from each group to understand the complexity and nature of different artefacts. This typology also shows future possibility of academic research on these artefacts.

2.2 Technology

3D reconstruction or digital documentation of buildings has been an active research topic in computer vision as well as in Digital Photogrammetry for many years. Three dimensional computer graphics are increasingly necessary for the promotion of heritage as they offer alternative possibilities for different

kinds of tourist activity as well as research and learning opportunities (Koutsoudis et al. 2007). Extensive research in the fields of Photogrammetry, computer vision and computer graphics has lead to the development of commercial 3D scanning systems that allow effective high resolution digitization of heritage sites within short times. However, the quality of the final product is determined in many cases by the software that has been used to produce 3D model.

This study has attempted 3D reconstruction of some selected buildings without using any expensive equipment (e.g. commercial 3D range scanners based on techniques like triangulation, modulation or time of flight) or commercial content creation software. This study neither has attempted to present any novel approach. But by using educational version of CAD software provided by Khulna university (as a part of study fourth year design studio), this study has tried to explore the potentialities of the tools offered by the application in documenting and 3D modelling. Ordinary low resolution cameras were used for photo shooting and perspective correction was done manually. For rendering, freeware rendering application (Sketchup) was used to reduce the overall cost.

2.3   Photography and 2D digital documentation

In this project field survey followed by digital photographic survey was conducted to collect all necessary measurement and detailed photograph. During shooting photographs we have found enormous difficulties to capture the whole façade as well as different parts of the buildings clearly, due to the surrounding obstacles (trees, bushes, fences, electric poles with cables etc). As the project was low-budgeted most of the photograph was taken without the use of any special constructions (e.g: scaffolding, bases etc.). Furthermore we have also faced some most noticeable and common problems of barrel distortion and trapezoid disfigurement of the building facades due to perspective. Correction of geometric distortion and remove obstacles was found very time consuming and labour intensive.

Drawings were then prepared digitally with Auto CAD application with those measurements that had been found through field survey and aided by photographs. Some parts of the buildings e.g. column capital, railing was traced digitally through importing those photographs (in scale) into CAD program. Annex A, shows detail drawings and photographs of some selected buildings that have already been documented in first phase. Even the output may seems very similar to traditional drafting and CAD based drafting, but the benefit of manipulating, altering, copying of any part or whole drawing at anytime is quite impossible in first case. That means CAD based digital drawing has a wider range of flexibility is drawing manipulation.

2.4   3D documentation and visualization

The act of 3D computer graphics in preserving historical sites has grown significantly during the past decade. This expansion can be attributed to advances in scanning techniques, virtual reality, computing power, 3D modelling tools, presentation devices, and other related technologies, which have made it possible to virtually re-create antiquities and buildings (Andreoli et al. 2006; Rashid 2005). According to Rahaman (Rahaman & Sharma 2005) all the three ways (Geometric modelling, Photogrammetry and Laser scanning) of digital documentation has their own means and appropriateness in different contexts. However, he claims that Laser Scanning

technology provides the most accurate 3D virtual model but it is the most expensive techniques as it requires sophisticated machineries. On the other hand 'Photogramettery' is the most one of the most ease technique but it needs relatively high resolution photographs from specific angles and expensive software. However, Geometric modelling technique is simpler but most laborious and time consuming.

Digital drawing (plan, elevation, sections etc.) which were prepared with AutoDesk's 'AutoCAD' program in the last phase are used as the base material. 3D models were then developed with the same software, as the program offers a wide range of modelling techniques inbuilt within the 'modelling' section. Due to low-cost budget, the study has avoided industry famous commercial modelling and rendering packages like 3D Studio Max, Maya etc.

According to the complexity of the building's plan and details, tools were preferred to work with 'Polygonal' modelling techniques and 'Boolean' solid modelling with editing option provided by AutoCAD®. It may also be possible to work with other software like 3D Studio Max or Maya etc. with techniques like: Nurb modeling or Patch modelling (Rahaman & Hossain 2007), for it's wider possibility of mesh editing. But as our objective was to explore low-cost solution, we kept using single application package for whole process. Finally, the 3D models were imported to 'Sketchup®' software (freeware solution provided by Google®) for photorealistic rendering by applying material and light.

Figure 5, shows 3D rendered model of 'Dakbanglow building'; located at the city centre at Khulna. Literally the word 'Dakbanglow' means 'rest house'. When Khulna 'Pauroshova' was established in 1884; a demand of a rest-house was raised for the 'Tax Collector' of British Government from Calcutta, India. Due to meet this demand this building was made by 'Zilla Porishod' in 1885 (Bari 1979). We have chosen *"Geometric modelling techniques"* to build this 3D model by AutoCAD and rendered (texture, lighting, shadow etc.) with Sketchup.

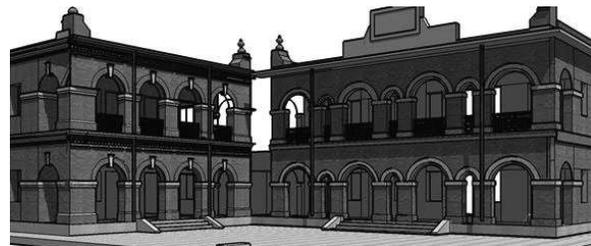Figure 4 : 2D detail CAD drawing
of 'Dakbanglow Building'

Figure 5 : 3D rendered model
of 'Dakbanglow Building' with SketchUp.

3. SUMMERY OF EXPENSES

In this study we have digitally documented (both in 2D and 3D) some historical buildings in Khulna, Bangladesh. Different instrument and free or low-cost software were used for this purpose. Due to inadequate financial support this study followed the most inexpensive approach. From our observation the minimum requirement of labour and facilities that is required for any digital documenting can be explained from this following table:

Particulars of works	Remarks
(a) Survey & documentation	
Building survey	Required 2/3 days/case study, costs $ 20~30/ building
Photography	Required digital camera, initial investment $200~300.
(b) Digitalization	
Drawing Preparation (2D)	Labour cost for drafting $10~20 /per drawing. Required Software: AutoCAD (used educational version, supported by Architecture Discipline, Khulna University), commercial version costs 7000$
Converting 2D from 3D	Labour cost approximate $50~300. (Depends upon project complexity) Used Software: AutoCAD
Digital Rendering	Labour cost approximate $50~200. (Depends upon project complexity) Used Software: SketchUp (*Google provides SketchUp as freeware)*.

Table 1. Required Labour and technical facilities for digital documentation.

4. DISCUSSION

Bangladesh is a land of indigenous development with rich architectural background. Hundreds of sites of rich in architectural heritage scatter all around the country. Some of these have unique characteristic. But due to lack of awareness and proper maintenance, we are going to lost them forever. It has been observed that conventional reconstruction and preservation systems are time consuming and expensive, moreover without highly skilled technical personnel proved futile. In such a situation an economic and flexible technique of conservation and documentation is inevitable for Bangladesh.

A 3D model or virtual model of a site or building not only provides some 'documentation' but also opens the possibilities for future research for preservationists, archaeologists, architects and historians. Even the interactive development of 3D models can empower the archaeologists to study, research and reconstruct. In this way new knowledge and better understanding about the investigated building can be attained and updated latter. An online documentation based on this digital data can be useful for a wider audience to "virtually" see and tour these sites and have a better understanding of the history of Bangladesh from a remote place of any part of the world.

This paper has discussed some recent techniques and their potentialities in digital documentation of heritage buildings. It has been found while documenting in 2D way; a drawing prepared 'digitally' provides more flexibility for future modification. On the other hand, for 3D documentation, as 'Laser Scanning' is expensive and 'Photogrammetry' requires expert and technical knowledge. Whereas, "Geometric Modelling" is more appropriate for ease and economic '3D digital modelling'. Even this method requires more time and labour, but we believe this is most appropriate method as cheap labour is available in Bangladesh. However, Laser scanning can produce high-resolution and high quality photorealistic models. Where as our models seems less detailed and some accuracy is missing too. But we believe, being a self funded project it is the optimum that we have produced. We believe as our experiences and workmanship is developing, we can also produced highly detail and sophisticated models in future if we got support from industrial render engine and graphics hardware.

The study has found initially some sort of financial investment is required to get modelling software and equipments but once having those accessories can be used on latter study. The author expect this study will help the authority and related personnel to understand the importance of preserving our built heritage, related expenses and the means of suitable techniques of 'Digital Documentation' of our past.

However we have found by default these 3D models produced by Sketchup inherit potentialities of web publication for greater audience. We hope to digitally preserve all selected buildings around Khulna city and published them in the web in future. Thus a comprehensive digital documentation and wide dissemination can help the city dwellers as well as people around the world to receive, synthesize, assimilate and classify the colonial artefacts as components of perceiving the colonial image of Khulna city.

5. REFERENCES

Addison, A. C., 2000. Emerging Trends in Virtual Heritage. *IEEE Multimedia,* 7(2), pp. 22-5.

Ahmed, N., 1984. *Discover the Monuments of Bangladesh,* Dhaka: University Press Ltd.

Andreoli, R., R. De Chiara, U. Erra, A. Iannaccone, F. La Greca & V. Scarano, 2006. Some Real Experiences in Developing Virtual Environments. *IV'06: Proceedings of the conference on Information Visualization*, pp. 545–52.

Bari, K. G. M. L. (ed.), 1979. *Bangladesh District Gazetteers Khulna,* Dhaka: Bangladesh Government Press.

Koutsoudis, A., F. Arnaoutoglou & C. Chamzas, 2007. On 3D reconstruction of the old city of Xanthi. A minimum budget approach to virtual touring based on photogrammetry. *Journal of Cultural Heritage,* 8(1), pp. 26-31.

Mridha, A. M. M. H. & M. A. Khan, 2002. Legacy of colonial architecture in Khulna city. *Khulna University Studies,* 4(2), pp. 713-24.

Rahaman, H. & S. M. Hossain, 2007. Representation of formal and Spatial Analysis in Computational Media : A case study of National Assembly Building in Dhaka. *Khulna University Studies,* (Special Issue).

Rahaman, H. & B. B. Sharma, 2005. Some Thoughts on Digital Documentation and its Application for Preserving the Architectural heritage of Bangladesh *Plan Plus : A journal for Planning, Development, Urbanization and Environment,* 03(01), pp. 11-21.

Rashid, M. M., 2005. Learning from the past – The case for a virtual reconstruction of the Paharpur Buddhist Monastery in *Proceedings of Architecture overcoming constraints, 11-13th June 2005* Dhaka, Bangladesh, pp. 157-60.

6. ACKNOWLEDGEMENTS