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POLISH-VIETNAMESE EXPERIENCE IN PRESERVATION AND CONSERVATION OF ARCHITECTURAL HERITAGE

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Application of 3D photogrammetry and simulation technology in conservation research of traditional brick structures Case study: Brick bridge system in Hue Citadel area

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Abstract. The system of brick bridges crossing Ngu Ha canal, in the area of Hue Citadel, built under the reigns of King Gia Long and King Minh Mang, following in the form of the traditional arch, are works of very typical value in terms of heritage, history, construction techniques, fine arts, architecture, landscape... Currently, most of these bridges are in a state of deterioration, damage, under the influence of time, severe weather in Hue and under the impact of the urbanization process, especially the conflict always exists between conservation and development (the need to travel and circulate more and more on the bridges...). The application of 3D scanning technology (photogrammetry) in the conservation research of traditional brick structure in general and the brick bridge system in particular is very necessary, in order to digitize the current data, analyze and evaluate, specify the characteristic values as well as status of degradation and damage, to build 3D models for simulating structures, architectural forms, architectural details and fine arts, traditional construction techniques...to assist in the conservation and restoration of the status quo in case the structures are damaged.
Key words: Hue, brick bridge, photogrammetry…

1. Introduction

Currently, the application of new technologies, especially 3D digitization technology in field surveys for conservation research in Vietnam, has achieved certain results. Specifically, the application of this technology helps researchers save time and costs of surveying. Most importantly, it brings high efficiency in data storage and data sharing in conservation research.

We, the authors, have applied 3D technology to a number of specific projects in Vietnam such as Bui Chu Church (Nam Dinh); Cham towers in Phu Dien (Thua Thien Hue), and tomb of King Minh Mang, (Hue).... Initially, we have had certain successes in data storage, data sharing, data analysis, in order to assess the current status and simulate the structure and architecture of the building based on the collected digitized data. Therefore, the author group continue to apply 3D scanning and simulation technology to the conservation research of the system of brick bridges crossing Ngu Ha canal, in the area of Hue Citadel, built under the reigns of King Gia Long and King Minh Mang, is a typical achievement for the fine arts and traditional construction techniques of Vietnam.

2. Application of 3D photogrammetry and simulation technology in conservation research of brick bridges crossing Ngu Ha canal

2.1. 3D photogrammetry and its applications for conservation research

The theory of 3D Photogrammetry was known to the world more than 100 years ago. However, it is really widely applied in many fields (medicine, remote sensing technology, archeology, heritage conservation, ...) in the past decade, based on the breakthroughs in technology of computer hardware and camera resolution. [1]

Currently, 3d photogrammetry technology has been widely applied in Vietnam mainly to store and share data for conservation research. In particular, it is used in digital museum projects for exhibition purposes. [2]. In addition, many research groups have applied this technology to simulate 3d graphics for heritage restoration. However, another advantage of this technology is

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