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Cultural heritage preservation efforts in Malaysia: A survey

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Abstract. Malaysia, just like its neighbouring countries in the region, has a rich and diverse culture and heritage treasures. What makes Malaysia more unique is its diversity as a multi-racial and multi-cultural country. These cultural heritages might become lost and extinct without any efforts in preserving and safeguarding due to modernization, assimilation, and globalization. We present an overview of different cultural heritage in Malaysia and available efforts to preserve these treasures found from literature. Digital preservation efforts that computer graphics, media scientists and practitioners could offer as alternatives in preservation of culture and heritage preservation will also be included in this paper.

1. Introduction
The need for cultural heritage preservation is certainly pressing, due to many factors such as development, modernization, climate change and assimilation. Due to its necessity, the United Nations Educational, Scientific and Cultural Organization (UNESCO) has established working committees and manuals to ensure that cultural heritage around the world receives proper attention and protection.

The context of cultural heritage relates to culture, heritage and cultural heritage. Culture has a broad meaning, but for clarification we refer to UNESCO's definition as the "complex whole that includes knowledge, beliefs, arts, morals, laws, customs and any other capabilities and habits" within a society. The World Heritage Convention in 1972 acknowledges that 'monuments, groups of buildings and sites' as heritage. However, as time progresses, interaction with humanity also has influence with the environment thus making the whole environment can be regarded as heritage.

There are different categories of heritage based on UNESCO's definition: cultural heritage, natural heritage and heritage in the event of armed conflict. We will outline different types of heritage in Malaysia in the next section, followed by efforts in cultural heritage preservation that were found in the literature. Highlight on the role of computer graphics technology in cultural heritage preservation will be presented before we conclude this paper.

2. Available Cultural Heritage in Malaysia
We will follow closely the categories outlined by UNESCO and the National Heritage Department, Ministry of Tourism and Culture Malaysia on various types of heritage available locally. Cultural heritage is diverse;

it is further divided into tangible and intangible cultural heritage. Tangible cultural heritage generally includes all things that can be observed such as things (movable – such as coins and paintings, and unmovable – such as sites and monuments) both on dry land and underwater. Intangible cultural heritage deals with a more subjective aspect such as tradition, dances and rituals. We listed some of the examples of cultural, natural and heritage in the event of armed conflict below – divided into those recognized in the UNESCO World Heritage list (Table 1):

Table 1. UNESCO World Heritage.

Category	World heritage in Malaysia
Natural Heritage Sites	a. Gunung Mulu National Park, Sarawak b. Kinabalu National Park, Sabah
Cultural Heritage Sites	a. Melaka and George Town, Historic Cities of Straits of Malacca b. Archaeological Heritage of the Lenggong Valley, Perak
Memory of the World	a.Correspondence of the late Sultan of Kedah (18 1943) b. Sejarah Melayu (The Malay Annals) c. Hikayat Hang Tuah d. Batu Bersurat Terengganu (Inscribed Stone Terengganu)
Global Geopark	Langkawi UNESCO Global Geopark, Kedah
Intangible Cultural Heritage of Humanity	Mak Yong theatre

At the national level, the National Heritage Act 2005 (Act 645) was tabled and endorsed in order to ensure conservation and preservation of the National Heritage; including sites, tangible and intangible cultural heritage, underwater cultural heritage, artefacts and related items. Some of the examples of natural heritage items (apart from those recognized by UNESCO) are:
- Sites (building): St Paul's ruin, Melaka, Carcosa Seri Negara, Sultan Abdul Samad (Supreme Court), Tugu Negara (the National Monument)
- Sites (archealogy): Gua Badak Archeological Site (Cave Drawing), Teluk Kelawar Cave
- Sites (natural): Taman Negara (National Forest - Peninsular Malaysia), Timbalai Triangulation Station
- Objects: Perak Man, Tengkolok Diraja (Royal headgear), Perahu Kemajuan (boat)
- Intangible (dances/performances) : Zapin, Gamelan, Wayang Kulit
- Intangible (traditional games): Wau, Gasing, Congkak
- Intangible (local delicacies): Nasi Lemak, Nasi Tumpang, Nasi Dagang, Laksa Johor

Note however, that the full list can be found on from National Heritage Department's website [1]. The National Heritage Department is the main body governing the regulations and enforcement of the National Heritage Act, besides conducting activities and seminars to create and strengthens awareness in the local community.

3. Efforts in Preservation of Cultural Heritage in Malaysia
Based on survey of the literatures, we present efforts done by various researchers related to cultural heritage preservation in Malaysia:

Malaysia is a member of ASEMUS (Asia-Europe Museum Network); which is a museum network collaboration targeting the use and sharing of objects in museum collection. As part of ASEMUS, there is a section called Virtual Collection of Asian Masterpieces (VCM) with the purpose of sharing museum collections across Asian and European museums. Visitors can search shared museum collections to view images and browse information related to the viewed object [2]. Malaysia participates with the virtual Islamic Arts Museum Malaysia, complete with some of the virtual exhibits as shown as Figure 1.
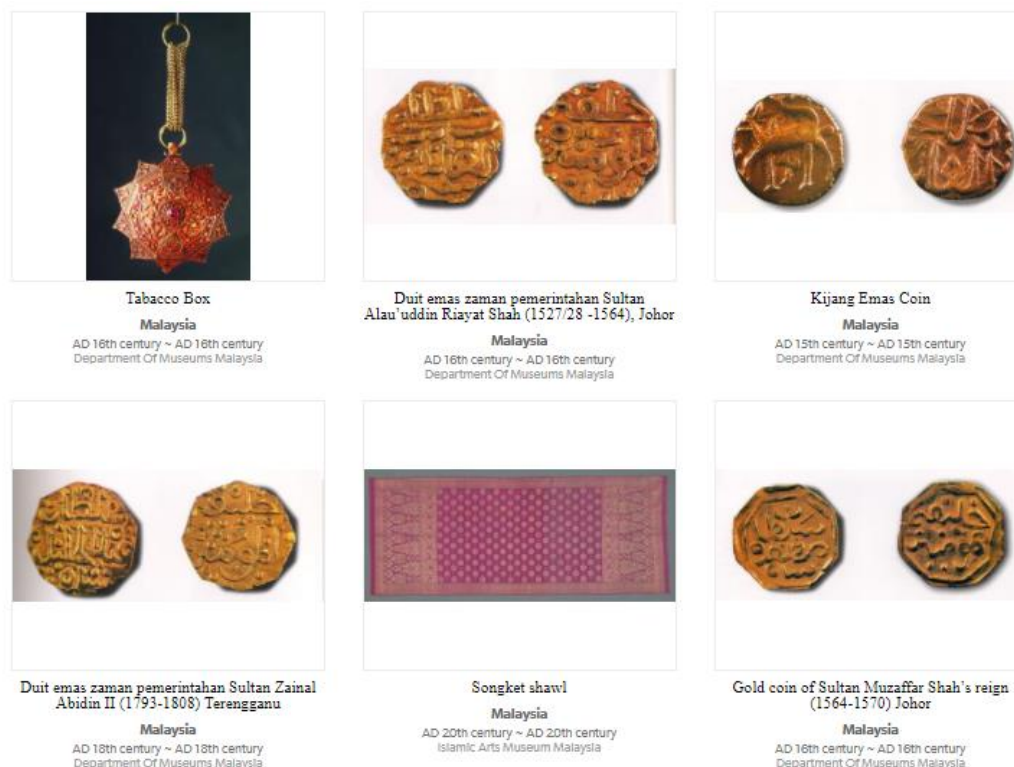

Figure 1. Some of the VCM exhibits from Malaysia [2].

Survey among local people and site observation related to identity of the historic sites (e.g. case study on Kuala Dungun and Taiping) [3] was conducted and another one on Malaysian public's perception on heritage buildings conservation [4]. There are also studies on issues in conservation and redevelopment in areas surrounding historic areas[5], on heritage building conservation (with pilot study)[6], formulation of best maintenance practice guidelines[7], sustainable best practice criteria[8] for Malaysian heritage building conservation, the challenges in conservation practices in Malaysia[9], and the use of Geographic Information System (GIS) technology as digital archive to manage heritage buildings and monuments in Melaka[10]. Similarly, proper asset management on virtual model of the sheltered pavilion of Pak Badol, which has been relocated to the Kelantan Museum of Royal Traditions and Customs for conservation [11] was proposed.

A virtual reconstruction of iconic heritage buildings [12], digital preservation of Malay architectural heritage (Rumah Tok Su – a traditional Malay house in Kedah) [13], recreating the 3D model of traditional Malay house (Teratak Zaaba) [14], virtual preservation of panoramic Kota Kuala Kedah[15] and 3D preservation of the A Famosa Fortress in Melaka[16] are among efforts done in using computer graphics and media technology in preservation of cultural heritage. Apart from that, a study on the potentials and

challenges in digitising facial expressions for preservation of a Malay folkdance called Mak Yong [17] was carried out recently.

Studies on performance and establishment measurements on the Geopark concept based on the indicator proposed by Global Geopark Network (GGN)[18] and into the practices of responsible tourism in the Kinabalu Park (UNESCO National Park)[19] were done related to natural heritage sites. The willingness of the tourism to pay the preservation works was also studied and creating value for sustainable tourism in the heritage site [20]. An improved technique for Land Use/Land Cover (LULC) map was proposed for the purposes of environmental monitoring and natural resources management purpose towards conservation of UNESCO Global Geopark - the Kilim Karst Geoforest Park (KKGP) in Langkawi [21].

Among those related to intangible cultural heritage are a study on the visual styles of the Wayang Kulit Kelantan and its capturing methods [22], design and development of interactive virtual Wayang Kulit [23], preservation of Wayang Kulit using multimedia technology[24] into an interactive game[25] and emulating the visuals of Wayang Kulit with Computer Generated Imaginary[26]. Other than that, studies on the determinants of food heritage through food identity [27] and based on age of public perceptions [28] were also done to preserve local food heritage and identity.

Computer game is also used as an indirect way to preserve cultural heritage and create interest and awareness among public. Example of this approach are interactive Wayang Kulit[25], a virtual heritage game called M-Heritage Hunt based on surroundings of George Town, Penang in Malaysia[29], presentation of the history of A Famosa using Game Based Learning methodology[30] and digital Congkak[31]. An AR application was developed to expose users on the masks of the Orang Asli Malaysia (part of the exhibition in the The Museum of Asian Art) as a fun, learning tool [32].

4. Computer Graphics and Media Research for Preservation of Cultural Heritage

We will discuss this topic mainly because our team consists of computer graphics and digital media researchers. Based on previous discussion, there are quite a number of research utilizing computer graphics and multimedia tools and approaches as outlined in the previous sections. It was stated that the first use of graphical representation in archaeology was in the late 1950s [33] using vector-based display. Computer graphics and multimedia technology has progressed to the state of being able to offer digital representation of world cultural heritage. However, it would be costly to set up an online world heritage site; for example, results from a committee appointed by the European Commission estimated 100 billion Euros cost for digitizing European cultural heritage [34].

Computer graphics and multimedia technologies have been used widely in documenting cultural heritage, especially the ones that fall under tangible heritage category. It can be used for the purpose of documentation, reconstruction, visualization, gamification and training towards cultural preservation and awareness. Research onto utilizing computer graphics and media technology into intangible cultural heritage is emerging rapidly.

Based on literature review of cultural heritage preservation in Malaysia, previous efforts were mostly channeled towards preservation of tangible heritage. Digital reconstruction of heritage site/building as a form of tangible heritage preservation is more distinct compared to digital preservation of intangible cultural heritage (ICH). Due to the diversity and subjectivity of ICH, digital preservation of ICH faces enormous technical challenges.

We took up the challenge of venturing into digital preservation of ICH especially for local context. Over the years, there are various research and development projects carried out by our research members that are related to traditional games such as natural interaction using Leap Motion for marble game[35] and Congkak[36] – these are some of the research examples combining affordable hardware (Leap Motion) to cater natural user interaction that incorporate ICH-related contents. Some of the scenes captured from the 3D experience are included as Figure 2 and 3.

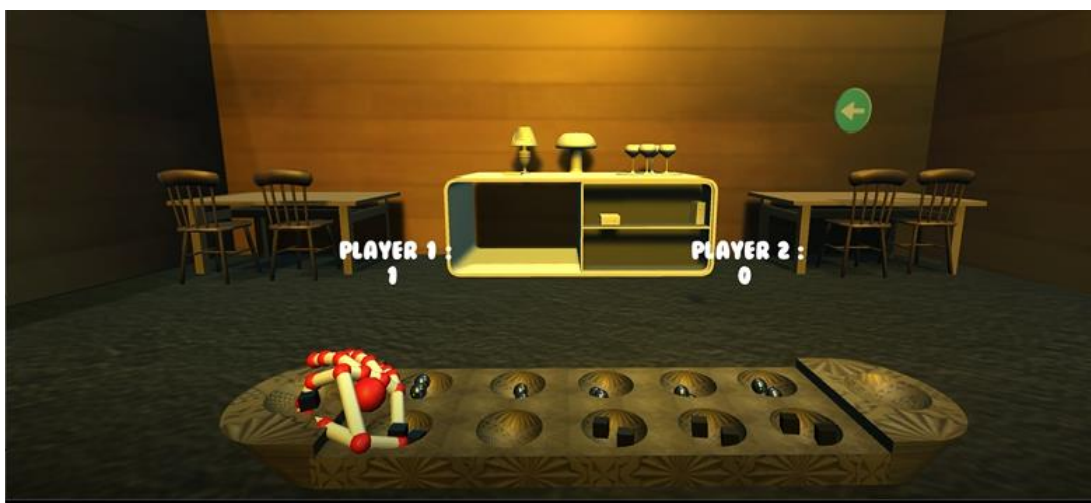**Figure 2.** Scenes from Marble Game[35].

Figure 3. 3D Congkak[36] incorporating natural user interactions.

An enhancement of virtual reconstruction of historical sites involving the use of augmented reality (AR) technology was done for ancient Malacca [37] – an early settlement in the Straits of Malacca. The use of AR in preservation efforts requires more research such as in object recognition/detection and design of interactions, apart from integration with the 3D environment.

We also work closely with Johor Heritage Foundation in exploring the possibility of using current technology in digital heritage preservation. Based on initial collaboration, we managed to get the involvements of UTM ViCubeLab researchers, undergraduate and postgraduate students to work together with the Johor Heritage Foundation. Experts in traditional dance took part in a series of motion capture data sessions (using marker (Figure 4) and markerless multi-camera systems (Figure 5)) and video recording (Figure 6) to get reliable Zapin dance data for further use.

The captured Zapin dance data were used in various research, for example a study on suitable algorithms to generate a more natural facial expressions for motion capture data re-use in 3D animation[38], to propose a method of extracting the 3D dance motion data of Zapin traditional dance from video data using keyframe animation extraction method[39] and a framework for constructing a 3D motion and skeleton using a monocular video source (2D video) targeted for traditional dance motion data extraction[40].
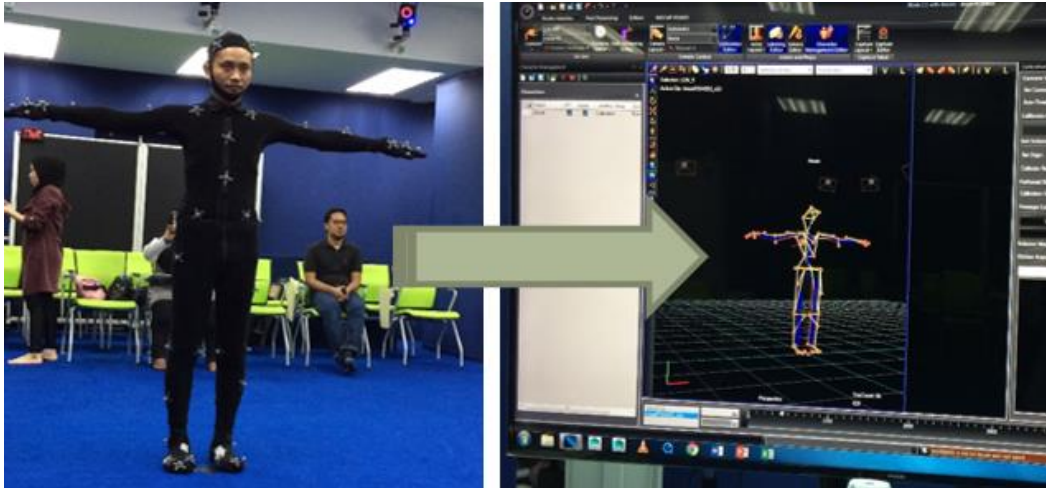
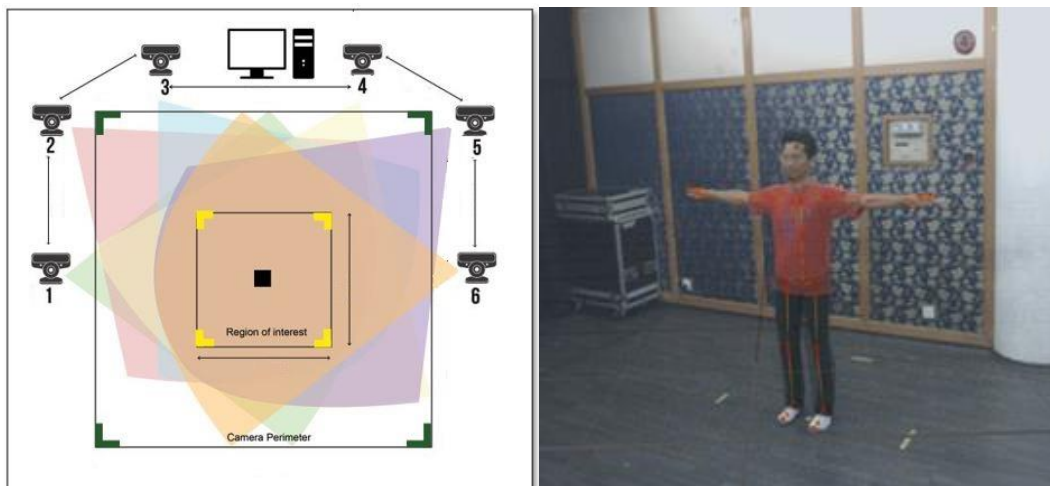**Figure 4.** Expert involvement in a marker-based motion capture session.

Figure 5. Camera setup (left) and expert involvement in markerless motion capture sessions.

Figure 6. Expert involvement (left) in video recording sessions.

On the lighter side, we managed to integrate heritage elements into our final year projects. Some of the examples are the study of fabrics and motives used for dance costumes as shown in Figure 7 (this was based on the visit to textile gallery at Johor Heritage Foundation) along with motion capture data re-use for animation [41], photogrammetry for artifacts reconstruction [42] and virtual museum on handheld device [43].
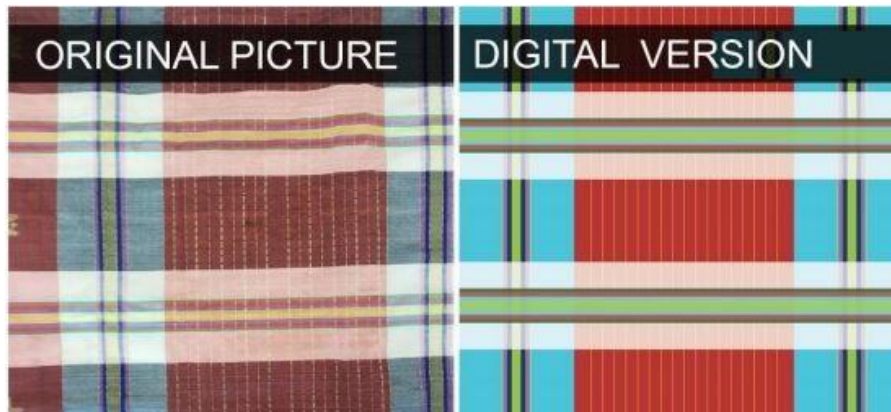

Figure 7. Original motive on textile (left) and the digital adaptation (right) [41].

5. Conclusion and Future Work

As a conclusion, we have seen the diverse cultural heritage available in Malaysia. Based on what were found from the literature, most of the preservation efforts (including usage of computer graphics and media) reported were mostly centered around tangible cultural heritage. Since computer graphics and media technology has so much to offer, there are endless possibilities for cultural preservation efforts digitally both for tangible and intangible cultural heritage preservation. Our team is currently working with Southeast Asian and European partners towards intangible cultural heritage preservation using computer graphics and computational science methods.

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