





PRESERVATION OF INTANGIBLE CULTURAL HERITAGE ON ZAPIN LENGA DANCE MOVEMENTS USING MOTION CAPTURE TECHNOLOGY



O 5456832 O NORSIMAA BINTI MUSTAFFA



SULTAN IDRIS EDUCATION UNIVERSITY 2021

















PRESERVATION OF INTANGIBLE CULTURAL HERITAGE ON ZAPIN LENGA DANCE MOVEMENTS USING MOTION CAPTURE TECHNOLOGY

NORSIMAA BINTI MUSTAFFA





05-4506832 vustaka.upsi.edu.my



THESIS PRESENTED TO QUALIFY FOR A DOCTOR OF PHILOSOPHY

FACULTY OF ART, COMPUTING AND CREATIVE INDUSTRY SULTAN IDRIS EDUCATION UNIVERSITY

2021









Please tick (√) Project Paper Masters by Research Master by Mixed Mode PhD

INSTITUTE OF GRADUATE STUDIES

DECLARATION OF ORIGINAL WORK

i. Student's Declaration:

I, NORSIMAA BINTI MUSTAFFA, P20151000207, FACULTY OF ART, COMPUTING AND CREATIVE INDUSTRY (PLEASE

 INDICATE STUDENT'S NAME, MATRIC NO. AND FACULTY) hereby declare that the work

 entitled
 PRESERVATION OF INTANGIBLE CULTURAL HERITAGE ON ZAPIN LENGA DANCE MOVEMENTS

 USING MOTION CAPTURE TECHNOLOGY
 is
 my

original work. I have not copied from any other students' work or from any other sources except where due reference or acknowledgement is made explicitly in the text, nor has any part been written for me by another person.

Signature of the student

ii. Supervisor's Declaration:

I TS. ASSOCIATE PROF. DR. MUHAMMAD ZAFFWAN BIN IDRIS (SUPERVISOR'S NAME) hereby certifies that the work entitled PRESERVATION OF INTANGIBLE CULTURAL HERITAGE ON ZAPIN LENGA DANCE MOVEMENTS USING MOTION CAPTURE TECHNOLOGY

10th JUNE 2021

fle

Signature of the Supervisor PROFESOR MADYA DR MUHAMMAD ZAFFWAN IDRIS JABATAN MULTIMEDIA KREATIF FAKULTI SENI, KOMPUTERAN & INDUSTRI KREATIF UNIVERSITI PENDIDIKAN SULTAN IDRIS

Date



INSTITUT PENGAJIAN SISWAZAH / INSTITUTE OF GRADUATE STUDIES

BORANG PENGESAHAN PENYERAHAN TESIS/DISERTASI/LAPORAN KERTAS PROJEK DECLARATION OF THESIS/DISSERTATION/PROJECT PAPER FORM

Tajuk / Title:

PRESERVATION OF INTANGIBLE CULTURAL HERITAGE ON ZAPIN LENGA DANCE

MOVEMENTS USING MOTION CAPTURE TECHNOLOGY

No. Matrik /Matric's No.: P20151000207

NORSIMAA BINTI MUSTAFFA

Saya / I :

(Nama pelajar / Student's Name)

mengaku membenarkan Tesis/Disertasi/Laporan Kertas Projek (Kedoktoran/Sarjana)* ini disimpan di Universiti Pendidikan Sultan Idris (Perpustakaan Tuanku Bainun) dengan syarat-syarat kegunaan seperti berikut:-

acknowledged that Universiti Pendidikan Sultan Idris (Tuanku Bainun Library) reserves the right as follows:-

- 1. Tesis/Disertasi/Laporan Kertas Projek ini adalah hak milik UPSI. The thesis is the property of Universiti Pendidikan Sultan Idris
- 2. Perpustakaan Tuanku Bainun dibenarkan membuat salinan untuk tujuan rujukan dan penyelidikan. Tuanku Bainun Library has the right to make copies for the purpose of reference and research.
- 3. Perpustakaan dibenarkan membuat salinan Tesis/Disertasi ini sebagai bahan pertukaran antara Institusi Pengajian Tinggi. *The Library has the right to make copies of the thesis for academic exchange.*
- 4. Sila tandakan ($\sqrt{}$) bagi pilihan kategori di bawah / Please tick ($\sqrt{}$) for category below:-



SULIT/CONFIDENTIAL



Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia seperti yang termaktub dalam Akta Rahsia Rasmi 1972. / Contains confidential information under the Official Secret Act 1972

Mengandungi maklumat terhad yang telah ditentukan oleh organisasi/badan di mana penyelidikan ini dijalankan. / *Contains restircted information as specified by the organization where research was done.*

TIDAK TERHAD / OPEN ACCESS

(Tandatangan Pelajar/ Signature)

Tarikh: _____10th JUNE 2021



(Tandatangan Penyelia / *Signature of Supervisor*) & (Nama & Cop Rasmi / *Name & Official Stamp*)

> PROFESOR MADYA DR MUHAMMAD ZAFFWAN IDRIS JABATAN MULTIMEDIA KREATIF FAKULTI SENI, KOMPUTERAN & INDUSTRI KREATIF UNIVERSITI PENDIDIKAN SULTAN IDRIS

Catatan: Jika Tesis/Disertasi ini SULIT @ TERHAD, sila lampirkan surat daripada pihak berkuasa/organisasi berkenaan dengan menyatakan sekali sebab dan tempoh laporan ini perlu dikelaskan sebagai SULIT dan TERHAD.

Notes: If the thesis is CONFIDENTAL or RESTRICTED, please attach with the letter from the organization with period and reasons for confidentiality or restriction.





ACKNOWLEDGEMENT

Firstly, I would like to express my gratitude to Allah Subhanahu Wa Ta'ala for His mercy and for giving me the strength and patience to complete my research against all circumstances. May peace and blessing of Allah be upon His Messenger, Muhammad (Peace be Upon Him).

I would like to express my deepest appreciation to my honorable supervisor, Ts. Associate Professor Dr. Muhammad Zaffwan Bin Idris for his full blast assistance, advice, support and patience throughout his supervision on my research. Thank you very much for the continuous guidance and all the knowledge given since I was in the early phase of my PhD journey.

Thank you very much to my co-supervisor, Ts. Dr. Ahmad Nizam Bin Othman for ⁰⁵⁻⁴⁵⁰⁶ being there to help and provide great ideas to enhance my research. I am also grateful to the following university staff, En. Mohd Fahemi Bin Ahmad Nordin, for the valuable knowledge and unfailing assistance on guiding me to use MoCap.

I also would like to express my sincere appreciation to my beloved parents, Professor Dr. Haji Mustaffa Bin Ahmad and Puan Hajjah Norlizah Binti Haji Hanafi, my sister, Norliyana Binti Mustaffa for all their treasured advice, support, prayer and blessing. To my lovely husband, Hilmie Syabil Bin Suhaimy thank you very much for the utmost patience, and for always being there when I needed you the most.

Nur Eliana Delisha, my newborn baby girl, thank you for bringing me more strength than I could ever have imagined possible. Thank you very much to all the lecturers, UPSI administrations, Pe-Zapin Johor team, MyBrain15 (MyPhD) scholarship, families, colleagues and all my friends for their encouragement and endless support.







ABSTRACT

This research examined the usage of Motion Capture (MoCap) technology in preserving the intangible cultural heritage of Zapin Lenga dance movements. Zapin Lenga dance was chosen as it is one of the oldest Zapin Melayu repertoires. The objective of this research is to preserve Zapin Lenga dance focusing on the main sixstep patterns known as langkah in correspondence with the dance motif named ragam. An experimental research design was employed for this research. The sample of this study was an expert male dancer on the Zapin Lenga dance. Two categories comprise of dancing with music and without music were selected. Three sets of dance performed by the expert dancer were recorded using MoCap with 51 reflective markers to segmentize the body movement. The captured data from MoCap were analysed in Motion Builder software using Laban Movement Analysis (LMA) model. Elements from LMA consist of Body, Effort, Shape and Space were used to determine variables on dance movements, which consist of i) acceleration, ii) body angle, iii) angle of rotation and iv) quadrant movement. Data analysis using paired sample t-test were conducted to examine the significance of mean differences of dancing with music and without music with a total number of 48175 frame-persecond (fps) captured for dancing with music and a total number of 46016fps captured for dancing without music. The distances between markers were measured to define speed (m/s^{-1}) , which later on determines the results of acceleration (m/s^{-2}) , body angle and rotation angle. It was found that there were no significant differences between the Zapin Lenga dance movements on both with music and without music (p-value<0.05). Thus, it reveals that the preservation of the Zapin Lenga dance movements can be conducted both with music and without music. This is the first attempt to calculate body movements accurately for Malay Traditional Folk Dance. This research will be used for other similar dance in Malaysia particularly in a different type of Zapin dances. The digital simulation of the movements can be virtually re-enacted in 3D software to be used in other applications such as animation and games.









PEMELIHARAAN WARISAN KEBUDAYAAN TIDAK KETARA TERHADAP PERGERAKAN TARIAN ZAPIN LENGA MENGGUNAKAN TEKNOLOGI *MOTION CAPTURE*

ABSTRAK

Penyelidikan ini mengkaji penggunaan teknologi Motion Capture (MoCap) dalam memelihara pergerakan warisan kebudayaan tidak ketara, iaitu tarian Zapin Lenga. Tarian Zapin Lenga dipilih kerana ia adalah satu-satunya repertoire Zapin Melayu Johor tertua. Objektif penyelidikan ini adalah untuk memelihara tarian Zapin Lenga yang memberi tumpuan kepada pola enam langkah utama dikenali sebagai langkah dalam korespondensi kepada sebuah motif tarian dinamakan ragam. Reka bentuk kajian eksperimen telah digunakan dalam penyelidikan ini. Sampel kajian ini adalah seorang penari lelaki, yang pakar dalam tarian Zapin Lenga. Dua kategori yang terdiri daripada menari dengan muzik dan tanpa muzik telah dipilih. Tiga set tarian yang dipersembahkan oleh penari pakar telah direkod menggunakan 51 penanda reflektif MoCap untuk membahagikan pergerakan badan. Data yang diambil dari MoCap dianalisis dalam perisian Motion Builder menggunakan Model Analisis Pergerakan Laban (LMA). Unsur-unsur dari LMA yang terdiri daripada Badan, Usaha, Bentuk dan Ruang digunakan untuk menentukan pembolehubah-pembolehubah mengenai pergerakan tarian yang terdiri daripada i) pecutan, ii) sudut badan, iii) sudut putaran dan iv) pergerakan kuadran. Analisis data menggunakan ujian-t sampel berpasangan telah dijalankan untuk mengkaji kepentingan perbezaan min menari dengan muzik dan tanpa muzik dengan jumlah keseluruhan 48175 bingkai sesaat (fps) dirakam untuk tarian dengan muzik dan dengan jumlah keseluruhan 46016fps dirakam untuk tarian tanpa muzik. Jarak antara penanda diukur untuk menentukan kelajuan (m/s⁻¹) yang kemudiannya menentukan keputusan pecutan (m/s⁻²), sudut badan dan sudut putaran. Telah didapati tidak terdapat perbezaan yang signifikan antara pergerakan tarian Zapin Lenga dengan kedua-dua muzik dan tanpa muzik (nilai-p<0.05). Ia mendedahkan bahawa pemeliharaan gerakan Zapin Lenga dapat dilakukan dengan muzik dan tanpa muzik. Ini adalah percubaan pertama untuk mengira pergerakan badan dengan tepat untuk Tarian Rakyat Melayu Tradisional. Kajian ini akan digunakan untuk tarian lain yang serupa di Malaysia terutamanya dalam Zapin. Simulasi digital pergerakan ini boleh dibentuk semula secara maya dalam perisian 3D untuk digunakan dalam aplikasi lain seperti animasi dan permainan.











TABLE OF CONTENTS

			Page
	DECLARATION O	F ORIGINAL WORK	ii
	DECLARATION O	F THESIS	iii
	ACKNOWLEDGEN	MENT	iv
	ABSTRACT		V
	ABSTRAK		vi
05-4506	TABLE OF CONTI	edu.my ENTS Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah	vii ptbupsi
	LIST OF TABLES		viii
	LIST OF FIGURES		ix
	LIST OF ABBREV	IATIONS	Х
	LIST OF SYMBOL	S	xi
	CHAPTER 1 IN	TRODUCTION	
	1.1 In	roduction	1
	1.2 Re	esearch Background	1







O 5-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah





		1.2.1 Intangible Cultural Heritage in Malaysia	2
		1.2.2 Digital Preservation of Malay Traditional Folk Dances	4
		1.2.3 Current issue on Intangible Cultural Heritage Preservation	10
	1.3	Problem Statements	13
	1.4	Research Objectives	14
	1.5	Research Questions	15
	1.6	Research Hypotheses	17
	1.7	Theoretical Framework	17
05-4506832	🕐 pust1.8u	POperational Definition Itan Abdul Jalil Shah	20 ptbupsi
		1.8.1 Acceleration	21
		1.8.2 Body Angle	21
		1.8.3 Angle of Rotation	21
		1.8.4 Quadrant Movement	22
	1.9	Research Scope	22
	1.10	Research Limitations	22
	1.11	Importance of the Research	23
	1.12	Summary	26





O 5-4506832 pustaka.upsi.edu.my f Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun vii

CHAPTER 2 LITERATURE REVIEW

	2.1	Introduction	27
	2.2	Intangible Cultural Heritage	27
	2.3	Zapin	32
		2.3.1 Zapin as Malay Traditional Art	35
		2.3.2 Dance in Zapin	37
		2.3.3 Music and Instruments in Zapin	40
		2.3.4 Costume in Zapin	41
	2.4	Transmission and Documentation in Digital Heritage	41
05-4506832	pustaka.u	2.4.1 Motion Capture Methods	44 ptbupsi
		2.4.2 Motion Capture Applications	48
		2.4.3 Motion Capture Technologies for Dance Applications	50
		2.4.4 Motion Analysis and Performance Development	54
		2.4.5 Folk Dance Digitisation using Motion Capture	57
	2.5	Laban Movement Analysis	62
		2.5.1 Body	65
		2.5.2 Effort	65

C

O 5-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun Viii

	2.5.3 Shape	66
	2.5.4 Space	67
2.6	Conceptual Framework	68
2.7	Summary	71

CHAPTER 3 METHODOLOGY

3.1	Introduction	72
3.2	Research Approach	72
	3.2.1 Quantitative Research	73
pustaka.u	3.2.2 Experimental Research	75 ptbupsi
3.3	Research Design	76
	3.3.1 Research Workflow	77
	3.3.2 Motion Capture System	80
3.4	Motion Capture on Dance Performance	81
	3.4.1 System Preparation, Character Creation and Calibration	82
	3.4.2 Recording	84
	3.4.3 Post-processing	85
	3.4.4 Exporting	85

C

3.5	3.5 Motion Builder				
3.6	Research Participant	87			
3.7	Data Analysis Methods	88			
	3.7.1 Acceleration	91			
	3.7.2 Body Angle	92			
	3.7.3 Angle of Rotation	94			
	3.7.4 Quadrant Movements	99			
	3.7.5 Angle of Inclination Analysis	101			
gg pustaka.u	3.7.6 The Sign in the Change of Rotation of the Hips and Shoulders psiledu my Kampus Sultan Abdul Jalil Shah	106 ptbupsi			
	3.7.7 Statistical Software	107			
3.8	Summary	108			

CHAPTER 4 FINDINGS AND DISCUSSION

4.1	Introduction	109		
4.2	Data Analysis			
4.2.1 Acceleration and Body Angle		143		
	4.2.1.1 Result on Acceleration and Angle on AC (left body part) for <i>Langkah 6</i>	144		





	4	4.2.1.2	Result on Acceleration and Angle on GI (left body part) for <i>Langkah</i> 6	147
	4	4.2.1.3	Result on Acceleration and Angle on P (left foot) for <i>Langkah</i> 6	151
	4	4.2.1.4	Result on Acceleration and Angle on DF (right body part) for <i>Langkah</i> 6	155
	4	4.2.1.5	Result on Acceleration and Angle on JL (right body part) for <i>Langkah 6</i>	159
	4	4.2.1.6	Result on Acceleration and Angle on R (right foot) for <i>Langkah</i> 6	162
	4	4.2.1.7	Result on Acceleration and Angle on AC (left body part) for <i>Langkah 1</i>	166
05-4506832	4 pustaka.upsi.edu.m	4.2.1.8	Result on Acceleration and Angle on GI (left body part) for <i>Langkah 1</i>	170 ptbup
	4	4.2.1.9	Result on Acceleration and Angle on P (left foot) for <i>Langkah 1</i>	173
	4	4.2.1.10	Result on Acceleration and Angle on DF (right body part) for <i>Langkah 1</i>	177
	4	4.2.1.11	Result on Acceleration and Angle on JL (right body part) for <i>Langkah 1</i>	181
	4	4.2.1.12	Result on Acceleration and Angle on R (right body part) for <i>Langkah 1</i>	184
	4	4.2.1.13	Result on Acceleration and Angle on AC (left body part) for <i>Langkah 2</i>	188
	4	4.2.1.14	Result on Acceleration and Angle on GI (left body part) for <i>Langkah 2</i>	192







	4.2	2.1.15	Result on Acceleration and Angle on P (left foot) for <i>Langkah 2</i>	195
	4.2	2.1.16	Result on Acceleration and Angle on DF (right body part) for <i>Langkah 2</i>	199
	4.2	2.1.17	Result on Acceleration and Angle on JL (right body part) for <i>Langkah 2</i>	203
	4.2	2.1.18	Result on Acceleration and Angle on R (right foot) for <i>Langkah 2</i>	206
	4.2	2.1.19	Result on Acceleration and Angle on AC (left body part) for <i>Langkah 4</i>	210
	4.2	2.1.20	Result on Acceleration and Angle on GI (left body part) for <i>Langkah 4</i>	214
05-4506832	4.2 pustaka.upsi.edu.my	2.1.21 f	Result on Acceleration and Angle on P (left foot) for <i>Langkah 4</i> Pustaka TBainun	217 O ptbup
	4.2	2.1.22	Result on Acceleration and Angle on DF (right body part) for <i>Langkah 4</i>	221
	4.2	2.1.23	Result on Acceleration and Angle on JL (right body part) for <i>Langkah 4</i>	225
	4.2	2.1.24	Result on Acceleration and Angle on R (right body part) for <i>Langkah 4</i>	228
	4.2.2 A	ingle of	f Rotation and Quadrant Movements	232
	4.2	2.2.1	Result on Hip for Langkah 6	233
	4.2	2.2.2	Result on Hip for Langkah 1	237
	4.2	2.2.3	Result on Right Shoulder for Langkah 6	241





O 05-4506832 O pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun Vii



		4.2.2.4 Result on Right Shoulder for Langkah 1	244
4.3	Data l	Findings	247
	4.3.1	Acceleration AC (Left Leg) with music and without music	248
	4.3.2	Body Angle AC (Left Leg) with music and without Music	249
	4.3.3	Angle of Rotation Hip (y-axis) with music and without music	249
	4.3.4	Quadrant Movement Hip with music and without Music	250
	4.3.5	Acceleration GI (Left Hand) with music and without music	251
pustaka.u	4.3.6	Body Angle GI (Left Hand) with music and without music	252 ptbup
	4.3.7	Angle of Rotation Hip (x-axis) with music and without music	252
	4.3.8	Quadrant Movement on Right Shoulder with music and without music	253
4.4	Discu	ssion	254
4.5	Sumn	nary	255

CHAPTER 5 CONCLUSION

Introduction 256 5.1

05-

5.2	Discussion	256
5.3	Research Guideline	258
5.4	Conclusion	261
5.5	Research Recommendation	263
5.6	Summary	265

REFERENCES

APPENDICES



O 5-4506832 S pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun bubysi















LIST OF TABLES

	Table No.		
	1.1	Research Questions and Research Objectives	16
	2.1	Comparison between Malay Zapin and Arabic Zapin	36
	3.1	Constant Parameters between Joints	89
	3.2	Critical Points between Joints	90
	3.3	Critical Points on Angles	93
05-4508	3.4	Position of the Hip in the Quadrant	101 ptbups
	3.5	Hip Coordination Points of (x, y and z)	102
	4.1	Segmentation on <i>Pantun</i> (Song Lancang Kuning) and <i>Langkah</i> in Zapin Lenga	111
	4.2	Constant Parameters between Joints	113
	4.3	Critical Points between Joints	114
	4.4	Zapin Lenga Dance Sequence with Music	115
	4.5	Zapin Lenga Dance Composition with Music	116
	4.6	Zapin Lenga Dance Sequence without Music	127
	4.7	Zapin Lenga Dance Composition without Music	129



	4.8	Zapin Lenga Data Extractions	139
	4.9	Zapin Lenga Dance Comparison with Music and without Music	142
	4.10	The comparison data on acceleration and angle AC for Langkah 6	144
	4.11	The comparison data on acceleration and angle GI for Langkah 6	148
	4.12	The comparison data on acceleration and angle P for Langkah 6	151
	4.13	The comparison data on acceleration and angle DF for Langkah 6	155
	4.14	The comparison data on acceleration and angle JL for Langkah 6	159
	4.15	The comparison data on acceleration and angle R for Langkah 6	162
05-4506	4.16	The comparison data on acceleration and angle AC for Langkah 1	167
	6832 4.17	The comparison data on acceleration and angle GI for <i>Langkah 1</i>	170 ptbu
	4.18	The comparison data on acceleration and angle P for Langkah 1	173
	4.19	The comparison data on acceleration and angle DF for Langkah 1	178
	4.20	The comparison data on acceleration and angle JL for Langkah 1	181
	4.21	The comparison data on acceleration and angle R for Langkah 1	184
	4.22	The comparison data on acceleration and angle AC for Langkah 2	189
	4.23	The comparison data on acceleration and angle GI for Langkah 2	192
	4.24	The comparison data on acceleration and angle P for Langkah 2	195



O 05-4506832 pustaka.upsi.edu.my F Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun bitur pustaka



O 5-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah



	4.26	The comparison data on acceleration and angle JL for Langkah 2	203
	4.27	The comparison data on acceleration and angle R for Langkah 2	206
	4.28	The comparison data on acceleration and angle AC for Langkah 4	211
	4.29	The comparison data on acceleration and angle GI for Langkah 4	214
	4.30	The comparison data on acceleration and angle P for Langkah 4	217
	4.31	The comparison data on acceleration and angle DF for Langkah 4	222
4 (C) 05-450683 4 4 4 4 4 4 4 4 4 4 4 4	4.32	The comparison data on acceleration and angle JL for Langkah 4	225
	4.33	The comparison data on acceleration and angle R for Langkah 4	228
	4.34	The comparison data on angle of inclination and change in angle of rotation to the y-axis Hip for <i>Langkah</i> 6	234
	4.35	The comparison data on angle of inclination and change in angle of rotation to the y-axis Hip for <i>Langkah 1</i>	238
	4.36	The comparison data on angle of inclination and change in angle of rotation to the y-axis Right Shoulder for <i>Langkah</i> 6	241
	4.37	The comparison data on angle of inclination and change in angle of rotation to the y-axis Right Shoulder for <i>Langkah 1</i>	244
	4.38	Result t-test on Acceleration AC	248
	4.39	Result t-test on Body Angle AC	249
	4.40	Result t-test on Angle of Rotation Hip (y-axis)	249
	4.41	Result t-test on Quadrant Movement Hip	250
	4.42	Result t-test on Acceleration GI	251





O 5-4506832 O pustaka.upsi.edu.my

4.43	Result t-test on Body Angle GI	252
4.44	Result t-test on Angle of Rotation Hip (x-axis)	252
4.45	Result t-test on Quadrant Movement Right Shoulder	253
4.46	Comparison between Preservation Research Variables	254





O 05-4506832 o pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah

PustakaTBainun Dtbupsi











LIST OF FIGURES

	Figure No.		
	1.1	Theoretical Framework	20
	2.1	Basic Categorisation on Zapin	34
	2.2	Zapin According to Three Main Dance Classifications	37
	2.3	Digitisation on Zapin	60
	2.4	Conceptual Framework	68
05-4506	⁸³² 3.1	Perpustaka upsi.edu.my Research Workflow	78 ptbups
	3.2	System Preparation and Calibration	83
	3.3	Markers Placement on MoCap Artist	84
	3.4	Quick Post and Data Clean Up	86
	3.5	Numerical Data Extraction	87
	3.6	Body Classification for Motion Analysis (Joints)	89
	3.7	Foot Classification for Motion Analysis (Joints)	90
	3.8	Distance Measured between Body Joints	92



O 5-4506832 Spustaka.upsi.edu.my



	3.9	Body Classification for Motion Analysis (Angles) using Cosine Rule	93
	3.10	Coordination Points (x,y,z) of the Left Shoulder	95
	3.11	Analysing Coordination Points (x,y,z) of the Hips and Shoulders	96
	3.12	The Coordination of the Hips in the Spherical Coordination System	97
	3.13	Segmentation of the Body into Quadrant	100
	3.14	Construction of Movement of Hips in a Quadrant	102
3.1 4.1 4.2 05-4506832	3.15	The Angles of Hips at $t = 1s$	107
	4.1	Anak Ayam Patah Dance Motif	112
	4.2	Body Classification for Motion Analysis (Joints)	112 O ptbups
	4.3	Foot Classification for Motion Analysis (Joints)	113
	4.4	Analysing Distance using Motion Builder	143
	4.5	Acceleration on AC for Langkah 6	145
	4.6	Body Angle on AC for Langkah 6	145
	4.7	Acceleration on GI for Langkah 6	148
	4.8	Body Angle on GI for Langkah 6	149
	4.9	Acceleration on P for Langkah 6	152
	4.10	Body Angle on P for Langkah 6	152



O 5-4506832 Spustaka.upsi.edu.my

	4.11	Acceleration on DF for Langkah 6	156
	4.12	Body Angle on DF for Langkah 6	157
	4.13	Acceleration on JL for Langkah 6	160
	4.14	Body Angle on JL for Langkah 6	160
	4.15	Acceleration on R for Langkah 6	163
4	4.16	Body Angle on R for Langkah 6	164
	4.17	Acceleration on AC for Langkah 1	167
4.18 4.19	4.18	Body Angle on AC for Langkah 1	168
	4.19	Acceleration on GI for Langkah 1	171
05-4506	4.20	Body Angle on GI for <i>Langkah 1</i>	ainun ptbupsi 171
	4.21	Acceleration on P for Langkah 1	174
	4.22	Body Angle on P for Langkah 1	175
	4.23	Acceleration on DF for Langkah 1	178
	4.24	Body Angle on DF for Langkah 1	179
	4.25	Acceleration on JL for Langkah 1	182
	4.25 4.26	Acceleration on JL for Langkah 1 Body Angle on JL for Langkah 1	182 182
	4.254.264.27	Acceleration on JL for <i>Langkah 1</i> Body Angle on JL for <i>Langkah 1</i> Acceleration on R for <i>Langkah 1</i>	182 182 185



O 5-4506832 Spustaka.upsi.edu.my

	4.29	Acceleration on AC for Langkah 2	189
	4.30	Body Angle on AC for Langkah 2	190
	4.31	Acceleration on GI for Langkah 2	193
	4.32	Body Angle on GI for Langkah 2	193
	4.33	Acceleration on P for Langkah 2	196
	4.34	Body Angle on P for Langkah 2	197
	4.35	Acceleration on DF for Langkah 2	200
05-450683	4.36	Body Angle on DF for Langkah 2	201
	4.37	Acceleration on JL for Langkah 2	204
	4.38	Body Angle on JL for <i>Langkah</i> 2	204 ptbups
	4.39	Acceleration on R for Langkah 2	207
	4.40	Body Angle on R for Langkah 2	208
	4.41	Acceleration on AC for Langkah 4	211
	4.42	Body Angle on AC for Langkah 4	212
	4.43	Acceleration on GI for Langkah 4	215
	4.44	Body Angle on GI for Langkah 4	215
	4.45	Acceleration on P for Langkah 4	218
	4.46	Body Angle on P for Langkah 4	219

O 05-4506832 pustaka.upsi.edu.my f Perpustakaan Tuanku Bainun PustakaTBainun PustakaTBainun	ptbupsi
---	---------

	4.47	Acceleration on DF for Langkah 4	222
	4.48	Body Angle on DF for Langkah 4	223
	4.49	Acceleration on JL for Langkah 4	226
4.50	4.50	Body Angle on JL for Langkah 4	226
	4.51	Acceleration on R for Langkah 4	229
	4.52	Body Angle on R for Langkah 4	230
4.53 4.54	4.53	Analysing Distance using Motion Builder	233
	4.54	Change in angle of rotation to the y-axis on hip for Langkah 6	234
	4.55	Change in angle of rotation to the y-axis on hip for Langkah 1	238
05-4506	⁸³² 4.56	Change in angle of rotation to the y-axis on right shoulder for Langkah 6	242 ptbupsi
	4.57	Change in angle of rotation to the y-axis on right shoulder for <i>Langkah 1</i>	245
	5.1	Zapin Lenga Dance Movements in MoCap	257
	5.2	Research Guideline	258









LIST OF ABBREVIATIONS

	AR	Augmented Reality
	.fbx	File type associated with 3D modelling applications
	HCI	Human-Computer Interaction
	ICH	Intangible Cultural Heritage
	INGO	International Non-Governmental Organization
	LMA	Laban Movement Analysis
05-45068	832 LED pustaka.ups	i.edu.my Ferpustakaan Tuanku Bainun Light Emitting Diode
	МоСар	Motion Capture
	MOTAC	Ministry of Tourism, Arts and Culture Malaysia
	NGO	Non-Governmental Organization
	UNESCO	United Nations Educational, Scientific and Cultural Organization
	VR	Virtual Reality
	2D	Two Dimensional
	3D	Three Dimensional









LIST OF SYMBOLS

	0	degree
	θ	angle
	fps	frame per second
	m/s^{-1}	meter per second
	m/s ⁻²	meter per second per second
	S	second
05-4506	832 Φ pustaka.ups	i.edu.my Perpustakaan Tuanku Bainun kampus Sultan Abdul Jalil Shah angle of inclination in the y-axis
	Φ'	change in angle of inclination in the y-axis
	Φ"	change of rotation in the y-axis
	θ	angle of inclination in the x-axis
	θ'	change in angle of inclination in the x-axis
	θ"	change of rotation in the x-axis
	α	angle of inclination in the z-axis
	β	angle of inclination in the horizontal plane











CHAPTER 1

INTRODUCTION

1.1 Introduction

05-4506832

pustaka.upsi.edu.my



This chapter discusses various aspects related to the research consist of research background, problem statements, research objectives, research questions, research hypotheses, theoretical framework, research scope, research limitation and importance of the research. In addition, this chapter also defines the operational definition of some important concepts used in this research.

1.2 **Research Background**

Discussion on research background includes a brief description about intangible cultural heritage and digital preservation of Malay traditional folk dances in Malaysia.



1.2.1 Intangible Cultural Heritage in Malaysia

Intangible cultural heritage is fragile by its very own nature as it hinges on practices and progressions through the environmental conditions. (1) Performing arts, (2) oral traditions and expressions, (3) social practices, rituals and festive events, (4) knowledge and practices of nature and the universe and (5) traditional craftsmanship had been defined as the categories in intangible cultural heritage (Text of the Convention for the Safeguarding of the Intangible Cultural Heritage, 2003).

Heritage is the identity, which passes on from generation to generation whereas cultural gives a sense of uniqueness and continuity to communities (Geismar, 2015). Meanwhile, intangible is the imitation and immersion transmitted through a practice as it lies principally in the human spirit. Dubé (2004) describes intangible cultural heritage as a living heritage because of its interconnection within the communities that recognise intangible cultural heritage as part of their cultural heritage.

Malaysia UNESCO Country Strategy (2018-2021) since the Eight Malaysia Plan, support national unity and integration by promoting the development of cultural heritage and empowering communities to enhance national identity (Mustafa & Abdullah, 2013). Malaysia and the 2003 convention have inscribed three elements namely Mak Yong Theatre (2008), Dondang Sayang (2018) and Silat (2019) as the Intangible Cultural Heritage of Humanity Representative List.





Malaysia is a country comprises of many races and cultures. The expressions on Malaysia's outstanding universal values are not only can be seen through their beautiful tangible heritage architectures, for examples in Melaka (Christ Church) and George Town (Kek Lok Si Temple), but also through their multi-cultural intangible heritage. The cultural elements that encounter between Malay Archipelago, India, China and Europe created a remarkable multi-cultural intangible heritage of variety ethnic in different faiths, worship and religious festivals, languages, arts, music, dances, costumes and foods (Boamah, Dorner & Oliver, 2012; Hennessy, 2012).

According to Mustafa and Saleh (2017), one of the five key elements of intangible cultural heritage in Malaysia is performing arts. Performing arts is a form of stage performances that can be conducted directly or indirectly to the audiences either spontaneously or by planning the presentation meticulously. Basic elements within performing arts include relationship between performer and audiences, time and space. There are three types of performing arts namely dance, music and theatre.

Dance according to Hawthorn (2019) and Bannerman (2014), is an artistic expression that shares commonalities with languages where the languages communicate according to cultural codes. The art of dances in Malaysia are divided into several dance genres such as traditional folk, modern, contemporary and dances that had been dedicated to the palace such as Joget Gamelan and Ceracap Inai. Dance in Malaysia embrace the Malay, Chinese, Indian, Sabah and Sarawak ethnic dances.

The traditional folk dances of indigenous Malays and diverse ethnic peoples of Sabah and Sarawak are truly enchanting. Meanwhile, as the Indian and Chinese







settled in Malaysia, the traditional folk dances that came from their homeland became a part of Malaysia's cultural heritage. Some examples of common traditional folk dances known within communities are Malay Asli dance, Inang, Indian Bharata Natyam dance, Chinese Fan dance, Sabah Sumazau dance and Sarawak Ngajat dance.

1.2.2 **Digital Preservation of Malay Traditional Folk Dances**

As the largest ethnic group in Malaysia, Malay has its own unique culture identity. Malay traditional folk dances had been influenced by few cultural practices such as formalise gestures, storytelling and martial arts. Malay traditional folk dances consist of dance movements, costumes, music and its musical instrumentations. Music and its musical instrumentations characterised each form of dances within Malay traditional folk dances (Idris, Mustaffa, Othman & Abdullah, 2017).

In 1990s, the search for meanings in folk dances became important. In year 1992, the Ministry of Tourism, Arts and Culture Malaysia set a yearly National Dance Festival to encourage active participation by the local dancers to showcase their folk dance traditions. Many groups and dance companies in the country started an earnest search for their own authentic dances. Sarawak, Sabah and Johor are among the states that won the 1992, 1993, 1994 and 1995 awards respectively.

Later, the traditional folk dances in Malaysia start to emerge from their earlier dance forms in terms of the creative rearrangements and styles. Expectations from the ever-changing audiences made the choreographers entangled between the hurry to





hook up with the new dance composition and in preserving traditional folk dance forms (Md Noor, 2001). Transitions of the traditional folk dances which are often slow and repetitive are made to appear spectacular and energetic to the audiences.

Folk dances in Malaysia began to adapt through variant situations where new creations develop through contemporary genre. This kind of effort is seen as a way to maintain Malaysia traditional folk dances as a living cultural heritage among societies. Traditional and new creations kinds and efforts are different but of the same cultural identity. The traditional folk dances and folk dances both serve as diverse to the composition of dances. They glow within the resemblance of the same genres.

According to Roza and Zulkifli (2017), Zapin in Nusantara grew and developed in accordance with the cultural identity of the local community. In Malaysia, both dance movements and music of Zapin belong to the Malay folk dances in Peninsular Malaysia. In Johor, Zapin is categorised as either Zapin Melayu (Malay Zapin) or Zapin Arab (Arab Zapin). Malay Zapin is the culture adaptation and assimilation from Arab Zapin. Its dance compositions are more strong and energetic.

Zapin is one of the most well-known identification by Malay-Islamic community that show a highly creative and intellectual tradition spread in insular Southeast Asia (Jähnichen, 2010). Zapin had taken roots in the region within Malay communities and emerge as the oldest traditional performances of the Malacca Straits from the time when the Hadrahmi-Arab traders coming in. In the old days, Zapin had been performed only by males in religious ceremonies. As time passed by, Zapin had become a way of society cultural entertainment where females are then able to dance.







The dance structures within Zapin consist of three main parts. First, is the opening part called Taksim. Second, is the part of motifs dance called Kopak. Third, is the closing part called Tahtim. Malay Zapin is differentiated by their dance patterns and types of music. In Johor, 16 Zapin had been listed by Yayasan Warisan Johor such as Zapin Pekajang, Zapin Lenga and Zapin Tenglu. Each Zapin are preserve either by their *pengasas* (founder), *pewaris* (heir) or *penerus* (successor). Dana, Zafin, Jipin and Jepin are among the names known for Zapin (Hanafiah, 2010; Ibnur, 2010).

Nowadays, the occurrence of new digital technology has permitted us to reach full potential in exploring and finding solution in the aspects of preservation. Digital technology helps in fulfilling the important aspects within digital preservation. In the mane of safeguarding, valuable resources are able to be digitised into digital environment. The documentations on tangible and intangible cultural heritage are rapidly digitised and made available over internet (Idris et al., 2017).

The United Nations Educational, Scientific and Cultural Organization (UNESCO) in its Charter for the Preservation of Digital Heritage (2003) realise that digital heritage preservations are made for the benefit of present and future generation. Preservation either on tangible or intangible cultural heritage offers broadened opportunities for creativity in creation, strength in communication and widening the knowledge that will be shared among all peoples around the world.

According to Karp (2014) and Cox (2011), not long ago digitisation was seen as conflicting to preservation. However, the developments in digital technology that offer reliable approaches in expanding the usage within digitisation area had shifted





the trend. Emergences of new digital technology also enhance the abilities on accessing our cultural heritage documentary. Cultural heritage is emerging as digital heritage (Hennessy, 2012). It is safe to say that today, digital technology is a part of human life.

Musiani and Schafer (2016) stated that in year 2016, the celebration of the twentieth anniversary of Internet Archive brings attention to societies for an early initiative of digital heritage preservation. Rapid development of digital technology starts to call for research addressing on legitimate digital heritage preservation. Some researchers and academicians as well as archivists and librarians among countries acknowledge the important of taking into account on appropriate digital preservation documentation including preservation strategies, methods, perimeters, policies, tools.

pustaka.upsi.edu.my **P**erpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah

Digital media develop as a platform of cultural heritage preservation that allows access and enhancement in digitised information environments. The manifestation of Virtual Reality (VR) and Augmented Reality (AR) emerge when digital media are used as tools or mediator to spread information and have become almost seamless with the real environment. 3D applications in interactive VR for examples game (Tang, Chan & Leung, 2011) and dance learning platform (Magnenat-Thalmann, Protopsaltou & Kavakli, 2008) had been used as teaching aids for users to learn dances.

Motion capture (MoCap) technology is an effective tool in digitising captured movements. MoCap is becoming progressively popular in preserving and disseminating art performances through recorded digitisation. Technically, the high

() 05-4506832





quality of the captured data allows improvisations on the movement that cannot be easily identified including stylistic variations (Aristidou, Stavrakis & Chrysanthou, 2014). MoCap technology has enabled the complex processes in recording and analysing of intangible cultural heritage such as performing arts including dance.

MoCap technologies are tools that show assurance for the preservation of dance performances. One of the most significant capabilities of MoCap over other methods for example video is the ability of these technologies to record live motion events and view moments in a dance where the recorded digital dance performances can be reconstruct from any arbitrary viewpoints. MoCap enables movements to be analysed in (Three Dimensional) 3D from 360 degrees, making it an easy reference for users to observe and emulate the movements (Mustaffa & Idris, 2017).

pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah

Digital preservation of tangible and intangible cultural assets in Malaysia involves activities through digital archives. National Archives of Malaysia, National Library of Malaysia, Department of Museums Malaysia, Department of National Heritage, National Department of Culture for Culture & Arts, National Academy of Arts, Culture & Heritage and National Visual Art Development Board under the Ministry of Tourism, Arts and Culture Malaysia (MOTAC) are among the organisation body engaged in preserving cultural heritage through digitisation.

The 360° Virtual Exhibition on Regional Gambus, Shadow Puppets, The Lost Kingdoms and Asean Songket Weaving are among the digital preservation efforts made by the Department of Museum Malaysia to strengthen, conserve and preserve national's historical arts, culture and heritage for future generation. Asean Cultural

() 05-4506832





Heritage Archive is another exertion on digitising Malaysia, Indonesia and Thailand cultural heritage properties where valuable information according to these countries artworks, objects and documents can be archived by users in 3D content type.

Emphasising on digital preservation of traditional folk dances through digitisation and archival in Malaysia, most of them had been preserved in digital formats including photo, video and audio which had been made available over internet. According to Kico, Grammalidis, Christidis and Liarokapis (2018), recording movements for example dance moves can be a complex process involving analysing and visualising motions where focus should be given to the overall dancing environments such as the dancer's relation to cultural context, sound and music.

05-4506832 Hence understanding artistic variations for examples emotion, expression or gender and dissimilar actions of human movements for example walking, jumping or running is among the main aspects in motion analysis (Aristidou, Stavrakis, Charalambous Chrysanthou & Himona, 2015). Principles of Laban Movements Analysis (LMA) support in defining human movements. Preserving dance movements through LMA including body, effort, shape and space permits the extracted motion to be analysed by determining the speed, velocity and acceleration. Meanwhile, calculation on the angle of rotation of the body reflects the artistic dance movements (Mustaffa & Idris, 2020).

> In this research, digital preservation of Malay traditional folk dance on Zapin Lenga using Lancang Kuning song through LMA had been conducted by the researcher. Zapin Lenga is a Malay traditional folk dance within Zapin Melayu



) 05-4506832 voitaka.upsi.edu.my



(Malay Zapin). Zapin Lenga was originated in Muar district and the oldest Malay Zapin repertoire found in Johor state. Zapin Lenga comprises of six-step patterns, known as *langkah*. Meanwhile, the original Zapin Lancang Kuning is one of the Zapin dances that still follow the structural step patterns based on the dance rules.

LMA elements consisting of body, effort, shape and space had been adopted in this research in order to identify qualities on dance movements. Zapin Lenga dance movements performed by the professional Zapin dancer had been analysed by considering musical rhythm based on Lancang Kuning song using segmentation method. Zapin Lenga dance movements had been segmented and the distances between markers had been measured to define speed. The result of the speed determines the velocity and acceleration of the motion in correspond to the music.

In the meaning of preservation, the researcher used MoCap technology to record and digitises human motions. MoCap had been used to see correlation between digitised data in recording complex Zapin Lenga dance movements with the actual dance performed by the professional Zapin dancer with music and without music.

1.2.3 **Current issue on Intangible Cultural Heritage Preservation**

pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah

In the last decade, the protection and promotion of tangible cultural heritage ranging from archaeological sites, monuments and natural parks, to intangible expressions such as folk traditions, social knowledge and practices has become an international central topic regarding its preservation strategies and policies (Alivizatou-Barakou et

() 05-4506832







al., 2017). UNESCO had been recognised as a key organisation in defining and outlining the meaning of cultural heritage since the end of World War II.

Governmental and non-government organisations around the world including professional associations as well as academic institutions actively participate in providing access to variety forms of cultural heritage information through the adoption from UNESCO series of conventions, administrative and financial measures. Through this process, a significant body of resources dealing with the protection, promotion and documentation through different technologies has been developed.

By the middle of year 1990s, international awareness about the consequences of globalisation had been increased dramatically. As the pace of cultural heritage transformation and globalisation displacement rises, questions on whether valuable traditions, practices and knowledge expressions within societies would survive the next generation (Kurin, 2014). There is also a critical concern that digital technologies might revolutionise the scientific content and public access to cultural heritage.

The protections of intangible cultural heritage become vastly protruding on international level when UNESCO through the Convention for the Safeguarding of the Intangible Heritage in 2003 charted the guidelines for safeguarding. As stated before, similar questions arise about the humanity's intangible cultural heritage had been threatened by the processes of globalisation. The developments of modern technologies are often regarded as a threat to the cultural heritage survival.









According to the Convention, national governments, cultural organisations and practicing communities are the main bodies who should be able to transmit this vulnerable intangible cultural heritage to their next generations. Even though the preservation methods, perimeter and tools might diverge based on each local and national perspective, the promotion and documentation of the intangible cultural heritage should be within the same safeguarding purposes and context guidelines.

According to Alivizatou-Barakou et al. (2017), Karp (2014), Hennessy (2012) and Cox (2011), although the emergence of new technologies and global mass culture are often be seen as a threat to traditional expressions, interestingly, it is these very technological inventions and innovations that are recurrently becoming a key part in preserving the intangible cultural heritage properties. Digital technology that offers reliable approaches improves way in disseminating information on cultural heritage.

In Malaysia, most digital preservation of intangible cultural heritage especially on performing arts is using primarily archival and encyclopaedic orientation. Ample valuable information had been made available online through several official websites under MOTAC. These institutions embarked on digitisation initiatives and had been taken steps in transforming their role into hybrid institutions that means by taking care both analogue and digital cultural heritage resources (Abd Manaf & Ismail, 2010).

Emphasising on dance preservation, even Malaysia is moving forward in embracing the usage of digital technology to provide universal and dynamic access, there is a concern on the limitation of the information availability regarding digital preservation of traditional folk dances using advance technological innovations tools





that suits specific technological methods for examples body motion and gesture recognition, facial expression analysis and modelling and 3D visualisation.

1.3 **Problem Statements**

Until now, few attempts on preserving intangible cultural heritage using body motion and gesture recognition can be found in Malaysia. Most attempts in preserving the traditional folk dances are based on text descriptions accordance to dance history, capturing images and recording videos of the people practising the dances. National Department for Culture & Arts Digital Archive is among the digitisation platform where users can retrieve information regarding Malaysia traditional folk dances.

pustaka.upsi.edu.my **P**erpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah

According to Calvert, Wilke, Ryman and Fox (2005), dance has probably been the slowest art form to adopt technology, partially because the tools do not cover the intangible performances preservation contexts such as in visualising and animating dance performances. Chan, Leung, Tang and Komura (2011), shown a research on dance-training systems based on MoCap technologies that could successfully guide students to improve their dance skills. Meanwhile, Shen, Wu, Lu and Cheng (2012), introduced the concept of using MoCap for national dances protection in China.

Therefore, it is important to recognise appropriate digital tool and related software that are able to express cultural heritage value and how that value is perceived by the end users. The main problem that has become focus of this research is there was no establish workflow or framework in digitising Malay traditional folk

() 05-4506832





dance using MoCap by recording and analysing the dance movements in 360°. Guidelines that can be used as reference in linking between components in Zapin dance and preservation method using MoCap technology are lack in resources.

This research also followed the presentation model conducted by Nagata (2004), Aristidou et. al (2017) and Aristidou et. al (2019) where researches has successfully preserved traditional folk dances. However, it is safe to say there is no such empirical study is evident yet that verifies the effectiveness of MoCap technology in preserving Zapin dance. To ensure reliability on safeguarding the Zapin dance, preservation with music and without music had been chosen as variables in order to determine do the influence of music components can affect the end results in preserving the overall Zapin Lenga dance movements.

pustaka.upsi.edu.my

1.4 **Research Objectives**

Generally, this research had been conducted to digitise and preserve Zapin Lenga dance movements. Specifically, this research starts with the following objectives.

- 1. To develop data capture workflow for real-time MoCap data recording for Zapin Lenga.
- 2. To analyse Zapin Lenga body motion and artistic movement's values of specific joints based on Laban Movement Analysis (LMA).

() 05-4506832



- 3. To apply a suitable technique and calculation in order to extract accurate MoCap numerical data for data analysis.
- 4. To develop a guideline presenting digital preservation of Zapin Lenga dance movements.

Research Questions 1.5

In order to conduct the research, research objectives had been described in the following form of research questions as also shown in Table 1.1.

- 1. What is the production stage involved in developing data capture workflow for real-time MoCap data recording for Zapin Lenga?
 - 2. What are the variables based from Zapin Lenga body motion and artistic movement's values of specific joints based on Laban Movement Analysis (LMA) to be analysed?
 - 3. What are the appropriate technique that can be used to extract accurate MoCap numerical data and the necessary mathematical method that can be used for data analysis?
 - 4. What is the component that can be used to develop a guideline for digital preservation of Zapin Lenga dance movements?







PustakaTBainun

Table 1.1

Research Questions and Research Objectives

(LMA) to be analysed?

	Research Questions	Research Objectives
RQ 1	What is the production stage involved	To develop data capture workflow
	in developing data capture workflow	for real-time MoCap data recording
	for real-time MoCap data recording	for Zapin Lenga.
	for Zapin Lenga?	

RQ 2 What are the variables based from To analyse Zapin Lenga body Zapin Lenga body motion and artistic motion and artistic movement's movement's values of specific joints values of specific joints based on based on Laban Movement Analysis Laban Movement Analysis (LMA).

What are the appropriate technique To apply a suitable technique and **RQ 3** that can be used to extract accurate calculation in order to extract MoCap numerical data and the accurate MoCap numerical data for necessary mathematical method that data analysis. can be used for data analysis?

RQ 4 What is the component that can be To develop a guideline presenting used to develop a guideline for digital digital preservation of Zapin Lenga preservation of Zapin Lenga dance dance movements. movements?







1.6 Research Hypotheses

05-4506832 😯 pustaka.upsi.edu.my

Preservation with music and without music had been chosen as variables in order to analyse to what extend the influence of music towards body motion and gesture recognition. Acceleration, body angle, angle of rotation and quadrant movements are elements associated with body, effort, shape and space within LMA. To ensure reliability on safeguarding, the following null hypotheses are presented.

- $H_0(1)$: There is no significance different between the acceleration on Zapin Lenga dance movements with music and without music.
- H₀(2): There is no significance different between the body angle on Zapin Lenga dance movements with music and without music.
 - $H_0(3)$: There is no significance different between the angle of rotation on Zapin Lenga dance movements with music and without music.
 - H₀(4): There is no significance different between the quadrant movement on Zapin Lenga dance movements with music and without music.

1.7 Theoretical Framework

LMA is a method developed originally by Rudolf Laban, which aims at building a notation on human movement's language, efficiency and expressiveness. LMA





provides definite description on describing and documenting all multiplicities of human movements. The LMA describes movements through four main basic elements of the motion consist of body, effort, shape and space. Even though this method has its drawbacks and needs a long training, it is one of the very few attempts at creating an establish relationship in understanding motions that have been broadly adopted.

The LMA framework has been broadly used to design specific movement technique in diverse areas including dance, choreography and theatre. Aristidou, Stavrakis, Papaefthimiou, Papagiannakis and Chrysanthou (2017), use LMA to extract motion characteristics to synthesis dance animation including stylistic variations of the movement. Aristidou et al. (2015) and Aristidou et al. (2014), develop a mechanism for body indexing by using LMA elements to identify qualities in dance motion. The researches correlate the performances through body notation calculation.

Representation of movement is generated by affective and compact motion recognition. LMA is a comprehensive and systematic approach in capturing movement expressivity (Burton, Samadani, Gorbet & Kulić, 2015). Most of the dance expressivity includes music. Numerous researches have addressed the studies on synchronising and synthesising dance motion sequences to music. Although some of their aim is to only preserve the dance content, these studies develop interesting approaches in analysing the dance movements using music segmentation method.

Music and dance by the means of cross correlation between dance movements and music can be seen as a way to preserved dance motion in the presence of music (Lee, Lee & Park, 2012). These studies can be group into three categories consist of





(1) matching music and motion, (2) synthesising dance motions given music and (3) synchronising dance motion to music. By recording the dance movements using MoCap, analysis and preservation process require the motion segments to undergo the process of clustering where the motion-music is group to musically similar cluster.

Laban theory of movements elaborates on a notation system for recording and analysing movements. The system precisely portrays temporal patterns, actions, floor plans, body parts and a 3D use of space. The basic elements of LMA which comprises of body, effort, space and shape where each of the elements had been subcategorised into further detail styles of movements provide an understanding on human body movements and expressiveness. Further explanation on LMA basic elements and subcategories will be discusses by the researcher in Chapter 2.

pustaka.upsi.edu.my **f** Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah

Figure 1.1 shows a theory selection in structuring a theoretical framework. LMA elements consist of body, effort, shape and space had been adopted by the researcher in order to extract Zapin Lenga dance movements and the artistic movement's values. In this research, dance movement are represented by the calculated speed, acceleration, body angle and quadrant movement of the whole body. Meanwhile, artistic movement's value is represented by the calculated angle of rotation at the hip and shoulder part. By determining the suitability of Zapin Lenga elements that is to be preserved using MoCap, all elements within LMA were adapted and analysed according to its interconnection to Zapin Lenga dance movements.

() 05-4506832







Figure 1.1. Theoretical Framework. Adapted from Laban Movements Analysis (LMA) by Rudolf Laban, 1879.

Operational Definition 1.8

This study involves several concepts related to the research variables. In order not to cause differences in interpretation, main variables definition consists of acceleration, body angle, angle of rotation and quadrant movement had been presented.







1.8.1 Acceleration

The acceleration component principally related to connection of the body movements within distance over time. It describes the structural and physical motions of the human body and is responsible for describing which body parts are moving.

Body Angle 1.8.2

The body angle component describes the pattern of the body effort on whole body joints (left and right body) and how the energy is being used on each movement.



1.8.3 **Angle of Rotation**

Angle of rotation component analyses the changes on body shape during body movements. It describes the artistic motions that the body takes and had been calculated through x-axis and y-axis coordination points as to see the relation of the body to itself. Angle of rotation focuses on torso parts (hip and shoulder) that change in shape to support movements in the rest of the body.









1.8.4 Quadrant Movement

) 05-4506832 😯 pustaka.upsi.edu.my

Quadrant movement component determine body movements in relation with the surroundings, pathways and lines of spatial tension where the space is within the reach of the body and the body actions take place. Quadrant movement classified the principles for body movements orientation based on four quadrants (Quadrant I, Quadrant II, Quadrant III or Quadrant IV) on a geometry plane.

1.9 **Research Scope**

This research focuses on the digital preservation of Malay traditional folk dance namely Zapin Lenga using MoCap technology. The main preservation element on Zapin Lenga is the dance movements. The preservation aspects within the Zapin Lenga dance movements consist of acceleration, body angle, angle of rotation and quadrant movement. Meanwhile for the digitisation tools, marker based MoCap is used for the real-time recording and presentation of MoCap data on Zapin Lenga.

1.10 **Research Limitations**

This research has several limitations as follow.

1. This research had been conducted only on Zapin Lenga dance movements using Lancang Kuning song. Since Zapin Lenga is the oldest Malay Zapin



repertoire found in Johor state and Zapin Lancang Kuning is one of the Zapin dances that still follow the structural step patterns based on the dance rules, this research focuses mainly on preserving the dance movements within the area of Malay traditional folk dance namely Zapin Lenga.

- 2. This research had been conducted using MoCap technology in order to record the Zapin Lenga dance movements. The Vicon motion system used 12 MoCap digital cameras and the optical system composed of 51 reflective passive markers placed on the professional Zapin dancer's body.
- 3. This research had been conducted without the use of depth sensing technology to produce a character avatar as representative of a human subject for animation as the researcher want to focus on developing an establish framework presenting the digital preservation of Zapin Lenga using MoCap. Application to a 3D environment is not explored due to technical limitation and non-availability of suitable commercial package.

1.11 **Importance of the Research**

This research presents a future comprehensive reference that can improve techniques in preserving the body motion and gesture recognition in dance movements. The development of MoCap workflow and framework in order to produce accurate data for recording and managing the Zapin Lenga dance movements contribute to the enhancement of digital preservation in dance area. The usage of MoCap technology to





digitise dance movement shows the importance of the research in the name of safeguarding the valuable intangible cultural heritage on performing arts.

The possible relationships between dance movements and music using optical MoCap Vicon system (passive markers) can create interesting approaches and tools in order to analyse dance motions (Zapin Lenga) and music (Lancang Kuning). This possibilities can further researches towards new application, knowledge, challenges and direction to achieve a better preservation method in the domain of digital heritage.

In this research, framework of several concepts from varieties disciplines including (1) the key elements in Malay traditional folk dance Zapin Lenga; dance, music, song and costume, (2) the basic elements in LMA; body, effort, shape and space and (3) the production stages in MoCap workflow; pre-production, production and post-production can assists in preserving another form of traditional folk dance.

Reliability, accuracy and relevancy on the extracted data of the Zapin Lenga dance movements using MoCap is important to provide learners with the necessary feedback for skill learning and performance enhancement. This research provides knowledge in digital preservation of Malay traditional folk dance in a way that supports learning process. This research is vital in initiating the idea to extract, record and analyse complex movements in dance where artistic movement's value is represented by the calculated angle of rotation at the hip and shoulder part.

Digital dance preservation may not have a standardisation process in the Malaysia. A more specific designation of what it means to preserve dance movements







PustakaTBainun

using digital technology would assist the design of such a standardised approach. This research can be seen suitable in the visualisation of a virtual performance for data analysis. The proposed framework is as also to preserve our intangible cultural heritage in Zapin dance as well as enabling the researcher to have a proper procedure in recording accurate Zapin dance movements using MoCap technology.

MoCap, whilst still in its infancy, is gaining popularity due to its increasing ability to free the user from constraints during performance, which have in the past been a concern with exoskeletal methods and cabling, and its ability to offer real time visualisation of the performance. The process of presenting a visually acceptable representation of an overall performance in addition to the numerical evaluation of specific joint orientation provides a significant contribution to knowledge.

pustaka.upsi.edu.my **F** Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah

Work presented in this thesis describes a workflow and guideline developed to produce a visually acceptable representation of a subject that can be used to visualise a performance through the animation of a realistic virtual human using MoCap technologies. A process for the visual analysis of an overall performance in addition to the numerical evaluation of specific joint orientation has been calculated and validated in order to preserve the overall motion of Zapin dance movements.

Where less established method of presenting pertinent recorded data in term of visual for a performer to duplicate performance, results from work presented here show that subtle variations in joint rotation can be clearly measured and could be used to improve dance performances and lead to digital heritage preservation and archives.

05-4506832





1.12 Summary

Digital information is increasingly important to our culture, knowledge and economy (Jharotia, 2018). The usage of digital technology in preserving our cultural heritage is one of the ways in protecting our legacy through the generation. It is important to know that digital cultural heritage itself is able to be comprehensive and effective to preserve our valuable belongings. Digital cultural heritage do best in offering the chances for the users to explore and learners to experience themselves on how the development and advancement of digital technology can assist in preserving and conserving our cultural heritage.

Digital preservation is necessary to make sure digital contents or objects can be located, rendered, used and understood in future. The results of this study will contribute to the development of the theory and method in relation to digital preservation of dance movements, specifically within the Malay traditional folk dance. In developing a framework to conduct this research, this chapter also describes on the research objectives, research questions, research hypotheses, theoretical framework, research scope and the operational definition that are related to the main variables in this study.



