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Designing Cham Font Unicode Standard And Cham Keyboard

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1. Introduction

- The Cham people using Cham script, from Devanagari since the 2nd century on Vo Canh stone stele [1]. While the Cham language appeared on stone stele in Tra Kieu in the 4th century [2,3]

- The Cham Textbook Compiling Committee (CTCC) has not yet supported to preserve the traditional Cham script.

- Most Cham elders, students, intellectuals, experts and Cham people strongly desire to conserve the traditional Cham script [3,5].

- Using Cham font to typing Cham scrip on the computer is needed. Thus, we offer solutions to design Cham font Unicode standard and Cham keyboard application include four options: Cham Thrah, Cham Latin, English and Vietnamese.

2. Literature Review

- For the use of Cham font, first the Cham-Pandarang and Cam-Tanran font was created for Macintosh and used for the Champa research by l'École française d'Extrême-Orient (EFEO). However, this font still has some defects and technical errors [6].
- The Cham Thrah font created by Sang (2002, 2012) and Bingu di tanran font created by Cham Unessco (2012) were developed from Cham-Tanran (EFEO), rebuilt, redesigned on the Windows keyboard. However these Cham fonts are not consistent in the value of the code page, and this causes many difficulties in the exchange of information.
- EFEO Panrang, EFEO Parik, and EFEO Udong font were created [7]. These three fonts are designed to be assigned directly to Windows and Macintosh keyboards platform and do not require accompanying application software. However, these three fonts were not used for Unicode standard range AA00-AA5F.
- With the approval of Unicode Standard range AA00-AA5F for Cham font, we continue to design and develop the EFEO Panrang, EFEO Parik, and EFEO Udong fonts based on this standard.

3. Methodology

- The research was implemented using a quantitative approach.
- The application was developed using ADDIE model.

3.1 Cham Font Unicode Standard

- First, based on the Unicode standard version 9.0, ranges AA00 - AA5F.
- Second, based on Times New Roman and Arial font.

3.1.1 Cham Font Analysis

- Total numbers of code point in range AA00-AA5F are 83.
- Numbers of code points have no character assigned are 13.
- Code point AA41 provided by Unicode standard in range AA00-AA5F is not in Cham script system.
- In range AA00-AA5F, final letter “wa matai” of Cham script system is missing.

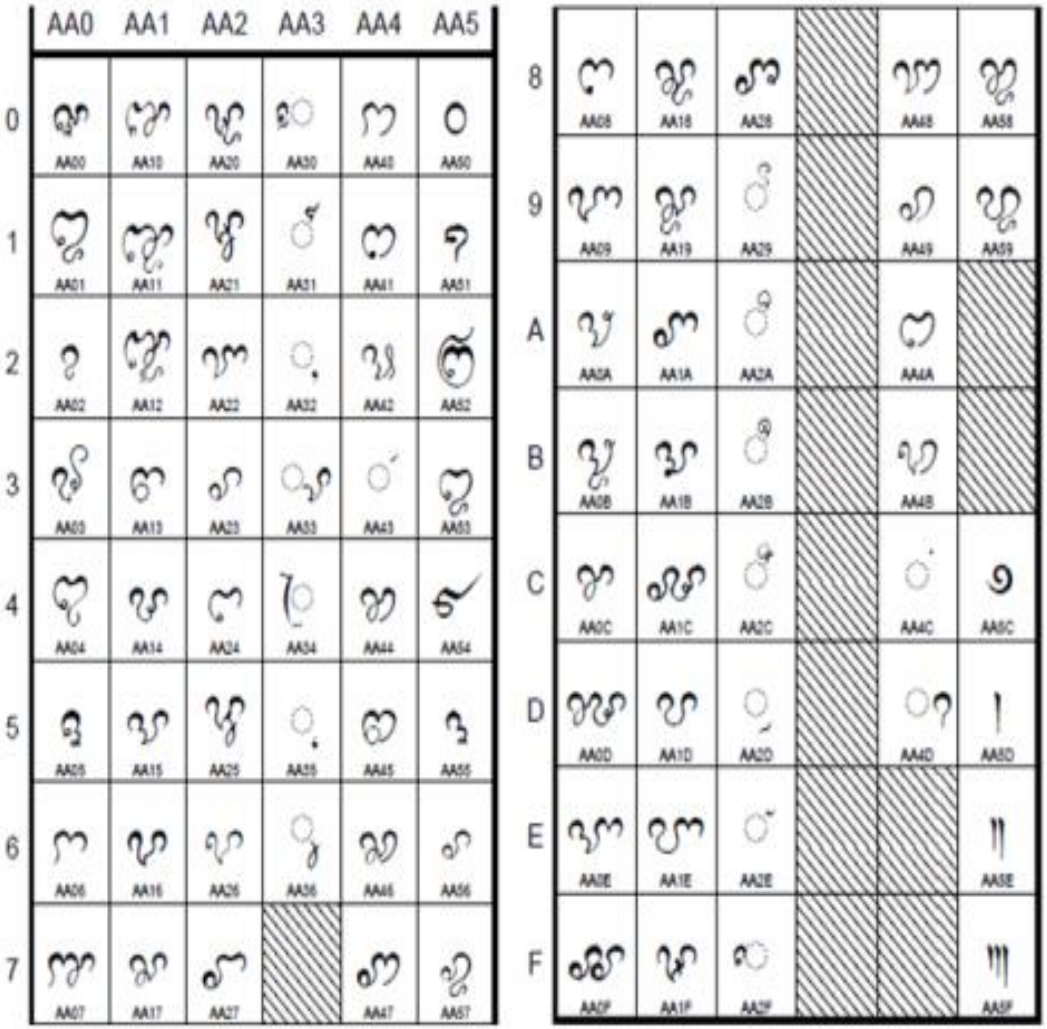

Figure 1. The Unicode standard version 9.0, ranges AA00-AA5F for Cham script

3.1.2 Cham Font Design

- Unicode standard for Cham font in range AA00-AA5F has a total of 83 letters.
- Design and add more 8 letters to the free space in range AA00-AA5F as shown in Figure 2.

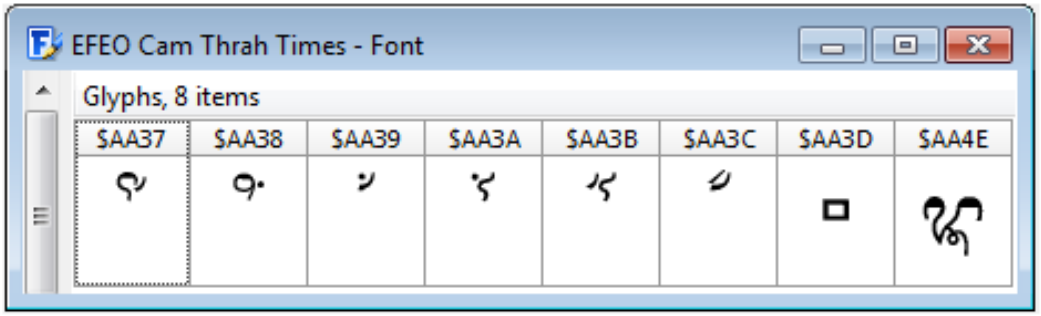

Figure 2. Number of code point add in range AA00-AA5F

- The total letters of Cham font in range AA00-AA5F needs to design are 91 letters as shown in Figure 3.

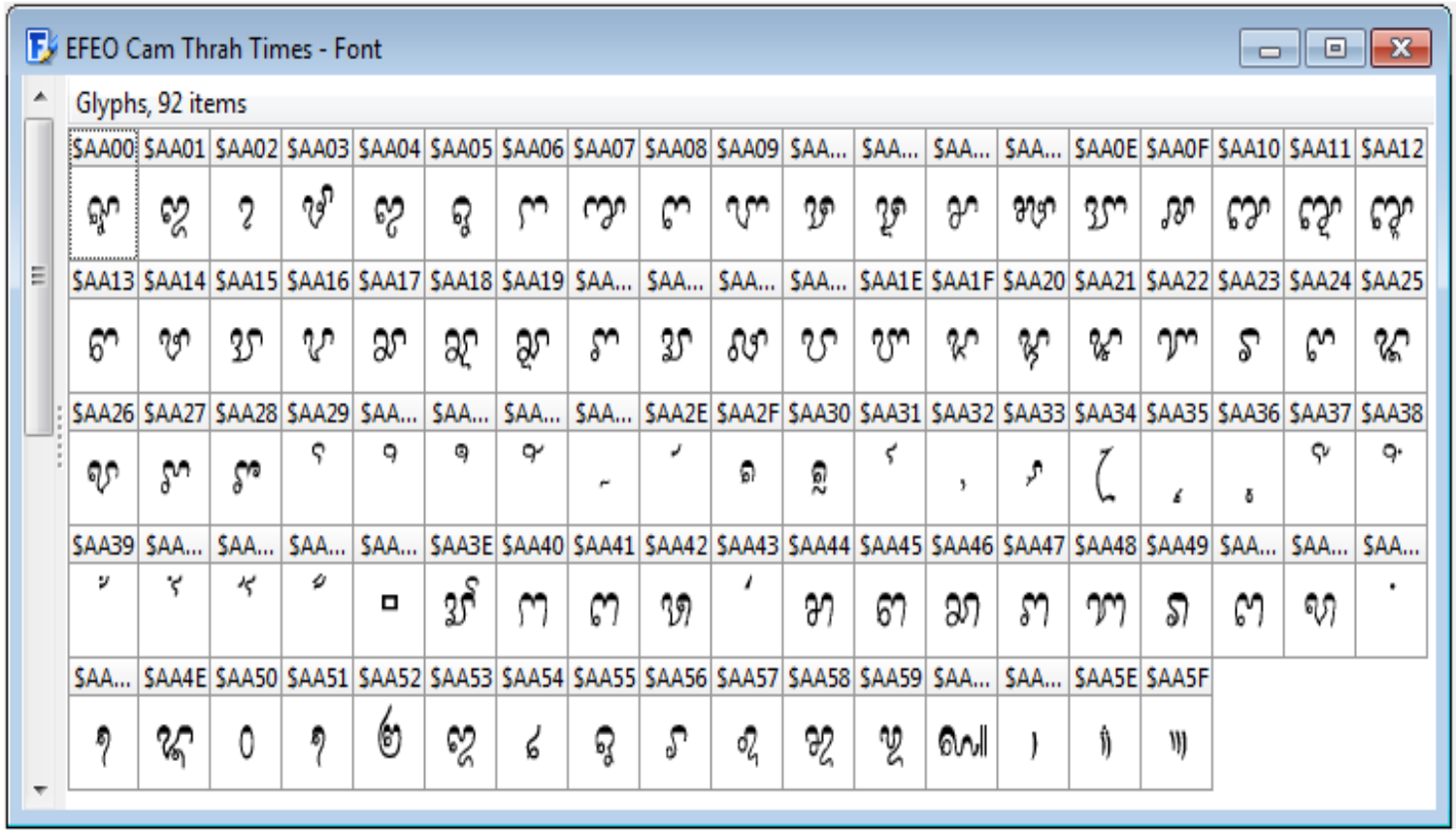

Figure 3. Total code point for Cham font in range AA00-AA5F

3.2 Cham Keyboard (Chamkey)

Chamkey design includes four functions: Cham Thrah, Cham Latin, English, and Vietnamese.

3.2.1 Cham Keyboard Analysis

- In order to design the appropriate keyboard, we develop the keyboard for Windows and Macintosh.
- Some case use lower case letter, shift key with lower case key, and some letters typed twice on the keyboard. See Figure 4 in detail.

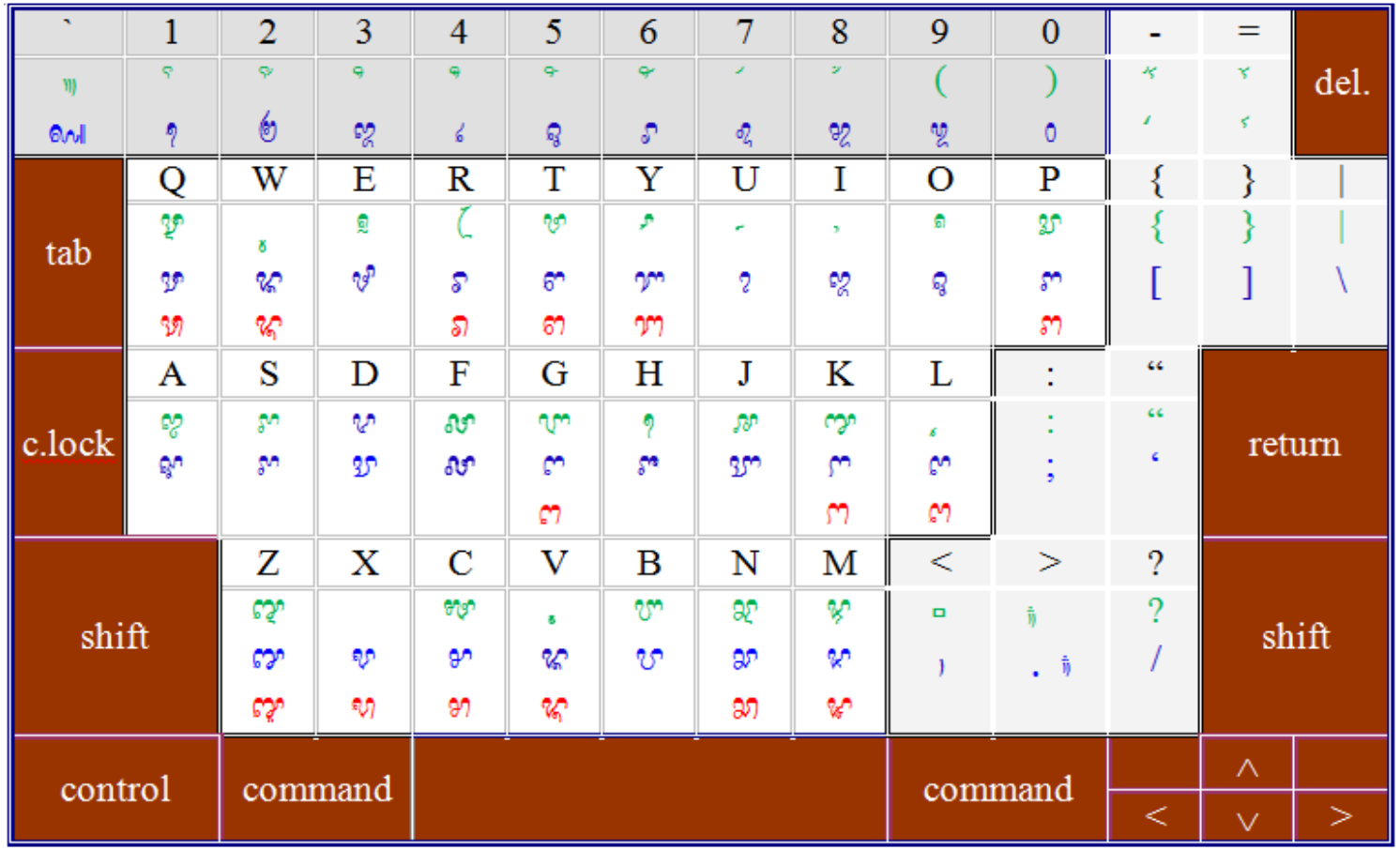

Figure 4. Cham keyboard layout

3.2.2. Cham Keyboard Design

For typing Cham script more convenient, we designed the keyboard and used the EFEO Cham Lain. The assignment is presented as below:

(i). Vowel group: vowel of Cham akhar Thrah has 6 letters

- AA00(a), AA01(i), AA02(u), AA03(e), AA04(ai, A), AA05(o)

(ii). Consonant group: consonant of Cham akhar Tharh has 35 letters.

- AA06(k), AA07(K, kh), AA08(g), AA09 (G,gh), AA0A(q, ng), AA0B(Q,Ng, NG)
- AA0C(c), AA0D(C, ch), AA0E(j), AA0F(J, jh), AA10(z, ny), AA11(Z, Ny, NY), AA12(zz, nj)
- AA13(t), AA14(T, th), AA15(d), AA16(D, dh), AA17(n), AA18(N), AA19(nd)
- AA1A(p), AA1B(P), AA1C(f, ph), AA1D(b), AA1E(B, bh), AA1F(m), AA20(M), AA21(mm, mb)
- AA22(y), AA23(r), AA24(l), AA25(w,v), AA26(x), AA27(s), AA28(h)

(iii). Final consonant: Final consonant or *akhar Matai* in Cham akhar Thrah use for the final position of a word, to end of a word. Final consonant of Cham akhar Thrah has 14 letters.

AA40(kk), AA41(ww,vv), AA42(qq, ng+tab), AA43(-), AA44(cc), AA45(tt), AA46(nn), AA47(pp), AA48(yy), AA49(rr), AA4A(ll), AA4B (xx), AA4C (.), AA4D(H),

(iv). Numeral group

AA50 (0), AA51(1), AA52(2), AA53(3), AA54(4), AA55(5), AA56(6), AA57(7), AA58(8),AA59 (9).

AA29(shift 1), AA37(shift 2), AA2A(shift 3), AA2B(shift 4), AA38(shift 5), AA2C(shift 6), AA2E(shift 7), AA39(shift 8)

(v). Extra signs

AA5C (`), AA31(=), AA43(- ), AA3B(shift -), AA3A (shift =), AA5F(shift `).

3.2.3 Cham Keyboard Application

- Application include four functions: Cham Thrah, Cham Latin, English and Vietnamese.
- Typing Vietnamese and English, Chamkey supports UniKey for Telex and VNI.
- Typing Cham Latin, Chamkey have embed the EFEO Cham Latin to Cham script conversion application.
- Typing Cham script, see Cham keyboard design and Figure 4.
- Using Chamkey in detail see Figure 5.

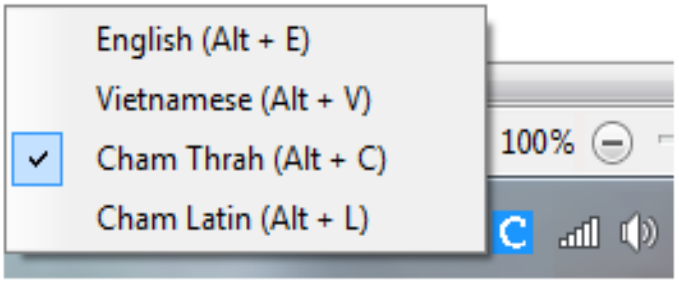

Figure 5. Chamkey interface on taskbar

4. Experiments

4.1. Acceptant Level of Cham Font

- Each question was answered on a scale from 1 to 5 to measure respondents' acceptance of the Cham font.

Table 1. The level acceptance of Cham Font

No.	Item	Agree	Strongly Agree	Total
1	These Cham fonts display text clearly on Internet Explorer	35 (64.81%)	19 (35.19%)	54 (100%)
2	These Cham font display text clearly on Mozilla Firefox	35 (64.81%)	19 (35.19%)	54 (100%)
3	These Cham font display text clearly on Google Chrome	34 (62.96%)	20 (37.04%)	54 (100%)
4	Cham font letter position run perfectly on application	19 (35.19%)	35 (64.81%)	54 (100%)
5	Cham font letter position on keyboard are easy to use	23 (42.59%)	31 (57.41%)	54 (100%)
6	The Cham font size is similar with the Times New Roman	18 (33.33%)	36 (66.67%)	54 (100%)

Based on Table 1, for all questions, the results showed that all 54 respondents (100%) either agreed or strongly agreed with every statement.

This indicates that the respondents had a good level of acceptance towards the Cham fonts. No respondent disagreed with any of the statemen

To analysis the level of Cham font, we compute the score of six items for each respondent. The result is displayed as in Table 2.

Table 2. Number of respondents and total score for Cham font

Number of respondents	Total score
10	30
4	29
5	28
18	27
1	26
4	25
12	24

In order to make decision, we decided to categorize the score to two categories as follow:

Table 3. Categories of total score for Cham font

Categories	Total score
Not Accepted	6 -18
Accepted	19 - 30

Based on Table 2 and Table 3, it can be concluded that all respondent 54 (100%) accept the Cham font.

4.2. Acceptant Level of Cham Keyboard

This section will address the level of acceptance of the Cham keyboard application. Each question was answered on a scale from 1 to 5.

Table 4. The level acceptance of Cham keyboard application

No.	Item	Agree	Strongly Agree	Total
1	Chamkey use typing Cham Thrah is very convenient	12 (22.22%)	42 (77.78%)	54 (100%)
2	Chamkey use typing Vietnamese is very convenient and stable	8 (14.81%)	46 (85.19%)	54 (100%)
3	Chamkey convert EFEO Cham Latin to Cham Thrah is very accurately	16 (29.63%)	38 (70.37%)	54 (100%)
4	Chamkey is easy to use	7 (12.96%)	47 (87.04%)	54 (100%)

Based on Table 4, for all questions, the results showed that all 54 respondents either agreed or strongly agreed. This result tells us that the respondents had a good level of acceptance towards the Cham keyboard application.

Results

- Firstly, we choose fifty four participants include academics, experts and students to evaluate the typefaces of Cham font using two forms.

Table 5. Typeface of Cham font

	EFEO Cam Times	EFEO Cam Arial
Not Accepted	0%	0%
Almost	0.88%	0.36%
Accepted	99.12%	99.64%

Based on Table 5, the two Cham fonts get high evaluation from respondents with the achieved results as following: EFEO Cam Times (99.12%), EFEO Cam Arial (99.64%).

- Secondly, we select a total of sixteen experts to evaluate four items (from Table 4). Each item of question was rated on a scale from 1 to 5. The level of acceptance from experts is presented in Table 6.

- From Table 6, the threshold (dm, n) for each item based on the expertise and the experts' percentage consensus ($d \leq 0.2$) for all six items was 100%, more than the required value of 75%. The value of d for the total construct is 0.08 (required $d \leq 0.2$). Thus, it can be concluded that all sixteen experts have come to a consensus that the Cham keyboard is acceptable.

Table 6. Threshold Value and Percentage Consensus by Experts

Experts	Items			
	I1	I2	I3	I4
1	0.03	0.01	0.04	0.03
2	0.03	0.01	0.04	0.03
3	0.03	0.01	0.04	0.03
4	0.03	0.01	0.04	0.03
5	0.03	0.01	0.04	0.03
6	0.18	0.01	0.04	0.03
7	0.03	0.01	0.04	0.03
8	0.03	0.01	0.04	0.03
9	0.03	0.01	0.04	0.03
10	0.03	0.01	0.04	0.03
11	0.03	0.01	0.04	0.03
12	0.18	0.01	0.04	0.18
13	0.03	0.01	0.04	0.03
14	0.03	0.01	0.16	0.03
15	0.03	0.19	0.04	0.18
16	0.03	0.01	0.04	0.03
Frequency $d \leq 2$	16.00	16.00	16.00	16.00
Percentage item $d \leq 2$	100%	100%	100%	100%
d value for total construct			0.08	

Conclusion

- We have presented a new approach in analysis, design and development for Cham font in Unicode standard range AA00-AA5F and Cham keyboard application with four options as Cham Thrah, Cham Latin, English and Vietnamese. The products were developed using the ADDIE model.

- In evaluation the acceptant level of Cham font and Cham keyboard, the result shows that all respondents are accepted. Typeface of EFEO Cam Times and EFEO Cam Arial was designed exactly for all alphanumeric Cham letters.

- In addition, Cham keyboard application was evaluated using Fuzzy Delphi get high consensus by experts.

Acknowledgment

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References

[1] Coedes, G. (1939). La plus ancienne inscription en langue chame. *Eastern and Indian Studies in Honour of F.W. Thomas. New Indian Antiquary Extra Series I. Po Dharma, " History of language and Cham script",Conference Proceedings on 21-22 September, 2006*. Kuala Lumpur, EFEO & Tokyo University of Foreign Studies, Kuala Lumpur, 2007 (CD-Rom).

[2] Lafont, P. B. (2011). *Vuong Quoc Champa: Dia Du, Dan Cu va Lich Su (Kingdom of Champa: Geography, Population and History*) (Vol. Champaka No. 11). San Jose, USA: International Office of Champa.

[3] Dharma, P. (2006). *Ngon ngu chu viet Cham trong qua trinh lich su (Cham language and script in historical process*). Proceedings of the 2006 History of language and Cham script. 21-22 September. Kuala Lumpur, EFEO & Tokyo University of Foreign Studies, Kuala Lumpur, 2007 (CD-Rom).

[4] Han, P. V. (2006). *Akhar Thrah voi viec cai tien cua Ban Bien Soan sach chu Cham (Akhar thrah with the improvement of Ban Bien Soan Soan Chu Cham).* Paper presented at the Conference Proceedings of the 2006 History of language and Cham script. 21-22 September. Kuala Lumpur, EFEO & Tokyo University of Foreign Studies, Kuala Lumpur, 2007 (CD-Rom).

[5] Phan, T. (2006). *Ngon ngu chu viet Cham trong qua trinh lich su (Cham language and script in historical process*). In Proceedings of the 2006 History of language and Cham script. 21-22 September. Kuala Lumpur, EFEO & Tokyo University of Foreign Studies, Kuala Lumpur, 2007 (CD-Rom).

[6] The, B. K. (Ed.) (1995). *Tu dien Cham - Viet (Cham - Viet dictionary)*. Nxb Khoa hoc Xa hoi: Tp. Ho Chi Minh (Science and Society).

[7] Van Ngoc Sang, Mohamad Bin Bilal Ali. *Designing Cham Fonts for Windows and Macintosh*. *Advanced Science Letters*, ISSN: 1936-6612 (Print): EISSN: 1936-7317. Vol. 20, No. 10-12 October 2014, pp. 1833- 1836 (4). [doi: http://dx.doi.org/10.1166/asl.2014.5639]. Publisher: American Scientific Publishers.

[8] Unicode, 2016, range AA00-AA5F, the Unicode Standard version 9.0, Copyright © 1991-2016 Unicode, Inc. All rights reserved. http://unicode.org/charts/PDF/UAA00.pdf

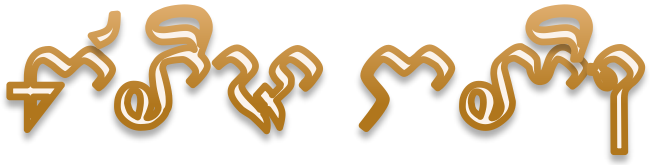
[9] Wikipedia (20170). Unikey. https://vi.wikipedia.org/wiki/B%E1%BB%99_g%C3%B5_ti%E1%BA%BFng_Vi%E1%BB%87t

[10] Van Ngoc Sang, Mohamad Bin Bilal Ali, Noor Dayana Abd Halim. "Exploring the Preferable Cham script to build the Conversion Application for Cham Latin to Cham Script". E-ISSN 2289-6996 (print). Vol 9, No. 1-3, December 2016. Published by Sains Humanika.

[11] Van Ngoc Sang, Mohamad Bin Bilal Ali. *Preserving Cham Font through Online Conversion Application*. International Education Studies. ISSN 1913-9020 (Print). ISSN 1913-9039 (Online). Vol. 8, No. 13 July 2015. [DOI: http://dx.doi.org/10.5539/ies.v8n13p60]. Publisher: Canada Center of Science and Education.

Thanks for listening

Terima kasih



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