"SARMA KEY BOARD"
FOR NUMBER-BASED TYPING

ABSTRACT :

The conventional keyboards for computer and communication gadgets have been designed with intense care and attention, such that people may type easily and comfortably. Still however, optimum comfort and efficiency has not still been achieved in these fields because of the following major reasons :

(i) Computer key board : (a) For typing texts, the fingers have to move and cover a space measuring about 22 cm X 10 cm (as per standard lap-top computer keyboard). This compels the wrist, elbow and even the arm to make movements. (b) Even though the comfortable positions of the hands for typing are : Right hand – 90 Deg. and Left hand- 150 Deg. with the width of human body, most of the time people have to work creating 90 to 110 Deg.

(ii) Mobile phone keyboard : Widely used languages like English, Arabic, Bengali etc. have 52, 28 + and 70+ scripts. The little space available in a mobile phone (say, about 4 cm X 6 cm) cannot comfortably accommodate this huge number. As a solution the manufacturers arrange 2, 3 or 4 letters in each key, such that those need to be pressed several times in order to get the expected letter.

The obvious solution of the above problems is to type with minimum numbers of keys. The concept of such a method has been developed by this author. The name of this keyboard has been given "Sarma Key Board". It should be mentioned here that the principle utilized in it has its origin in "Sarma's Unified Script" (Ref. 01 and 02), invented by this author and Dr. Mira Rani Sarma (Parai).

INTRODUCTION :

There is no limit of development. And there seems ample scope of developing the keyboards used for typing the texts. Making a keyboard with less number of keys may help the long-time users to work less with their hands and fingers and the same may also enable the mobile manufacturers to accommodate the keyboard in limited space. However, the major space of the keyboard is occupied by the letters of the language, which may range from 30 to 80 or more. There is no possibility of reducing this number unless the number of keys for typing fonts can be reduced. The expression of the fonts by number may be a good solution. In this case only 9 digits may be required for numbering any number of letters. This however, will be an arbitrary job, because here the job is not only to replace the letters by numbers, but also to make a unified system through which the fonts of all languages can be easily identified, numbered, typed, transmitted and then reconstituted.

After SUS (Sarma's Unified Script) has been published, it is now possible to think of a systematic way to do this job. The concept of "Sarma's keyboard" in which has been prepared on the basis of the principles utilized in SUS. The topics which will be discussed in this paper are :

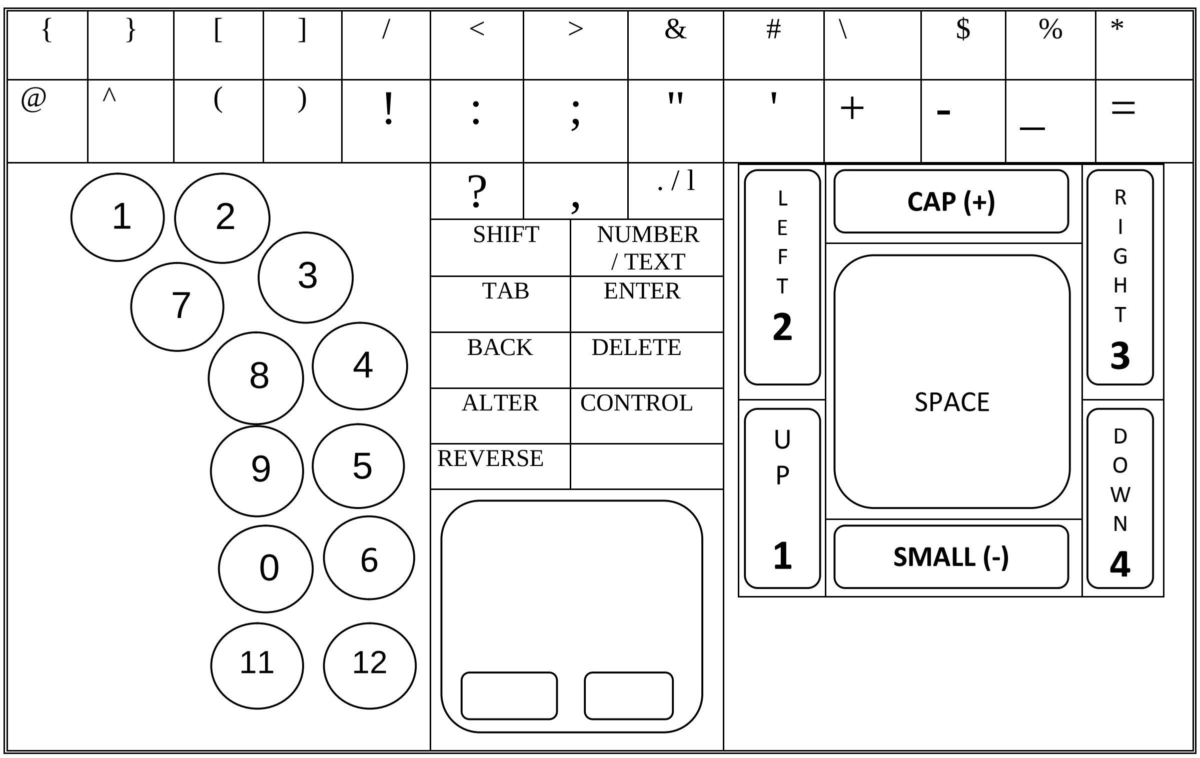
(i) Design of ‘Sarma Keyboard’ for computer,
(ii) Design of ‘Sarma Keyboard’ for mobile phone,
(iii) Typing various languages (viz. English, Arabic and Bengali) and
(iv) Brief comparison between traditional and Sarma keyboard,
(v) Transmission of texts etc.

(i) DESIGN OF ‘SARMA-KEY BOARD’ FOR COMPUTER :

For typing texts, in a standard laptop keyboard there are 26 double shift keys for letters and 20 double shift keys for numbers and punctuation marks. The keys provided in ‘Sarma-Key Board’ are : Number keys -10 / 12, Punctuation and other keys – 30 and 6-way navigation key - 1.

Keeping the topmost row used for computer management as it is, all other rows (i.e. row of number keys, Q to P row, A to L row, Z to M row and the space-bar row) has been replaced by a new set of keys. A sample arrangement of these keys has been shown in **Figure No. 01 Proposed Key Board** (for computer) below.

Figure No. 01 Proposed Sarma Key Board (for computer)



SYSTEM OF OPERATION :

The key board will be operated by the fingers, when rest of the hand will remain mostly at rest. The left hand can be placed even at 150 Deg. angle for convenience, while the right hand, at (say) 90 Deg. While typing, the fingers of left hand can be placed on numbers 1 to 12 (where 0 represents 10) on the left. The navigation key has been designed in such a way that the right hand can operate the 7-way navigation key can operate the keys without any movement of wrist. Also the operation keys and most of the punctuation keys have been placed in a location such that these can be operated with very little movement the right and left hands.

01. The NUMBER / TEXT key (preferably fitted with indicator light) is a two-way switch. In the "NUMBER" condition any of the numbers can be typed as usual. In "TEXT" condition, the finger of the left hand may press any of the numbers and a letter will appear in the monitor (explained letter). By a single strike, 10 different letters can be typed in this way. Also, while the left hand finger may keep any of the numbers pressed, fingers of the right hand may press any of the keys marked '1', '2', '3' or '4' of the navigation key. Thus 12 X 4 = 48 different letters can be typed in this process of one press and one strike each. Thus this key board is capable of typing 10 + 48 = 68 letters of any language.

02. The "SPACE BAR" is at the middle of the navigation key.

03. When no number is kept pressed on the left, the navigation keys marked "LEFT" and "RIGHT" control the movement of the 'Cursor' in respective directions. Similarly the keys marked 'UP' and DOWN' control its upward and downward movements.

04. The navigation key marked 'CAP' makes Capital letters and 'SMALL', the small letters in case of English alphabet.

05. The navigation key mentioned in 04 and marked 'CAP (+)' and 'SMALL (-) is to be used in Bengali for showing combined letters.

06. The 'SHIFT' key is not required for Capital or Small letters. It is to be used for highlighting letter, word or sentence along with movement of the cursors.

07. Other keys viz., TAB, ENTER, BACK, DELETE, CONTROL etc. would have the conventional operations.

08. The REVERSE key will be used for the languages that writes from Left to Right (viz. Arabic).

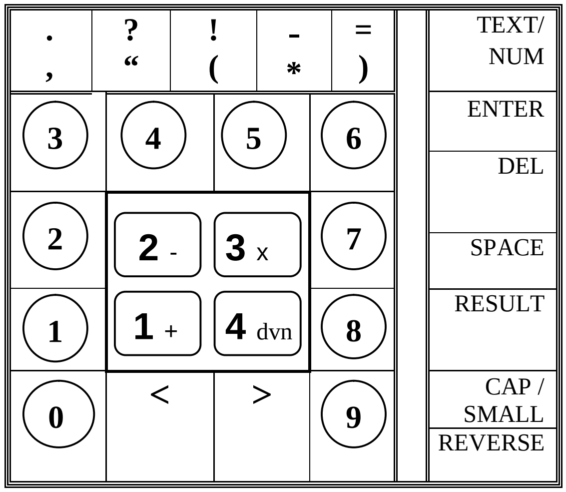
09. The touch pad at the middle is the substitute for 'Mouse'.

(ii) DESIGN OF 'SARMA KEYBOARD' FOR MOBILE PHONE :

While space problem is absent in case of keyboard for computer, the same is acute in mobile phones. In addition, in mobile phone the typing need to be done by one finger, while one palm holds the phone. In this reality Sarma Keyboard for mobile phone has been designed in a different way.

The top two or three rows including the navigation key used for management of phoning operations has been retained as it is. The lower rows of keys used for typing have been replaced by a new set. A sample arrangement of these keys has been shown in **Figure No. 02 Proposed Key Board** (for mobile phone).

Figure No. 03 Proposed Sarma Key Board (for mobile phone)



SYSTEM OF OPERATION :

The keyboard board will be operated by one finger, while the other hand would hold the set. The keys on the topmost row are ‘double-option keys’, where pressing once would activate the lower sign and twice, the upper sign. Other keys are mostly of single strike operation. The five keys on the left have ‘punctuation signs’.

01. The NUMBER / TEXT key is a double-option key.

(a) In the “NUMBER” condition, the digits written within circles are activated. These can be used for normal saving by pressing ‘ENTER’ key. In this condition these can also be used for Calculation. For this purpose the calculation signs (i.e. **+ - x** and **divn)** are to be used from the central 4 keys shown in Bold. The RESULT key at the corner would give the result.

(b) In the “TEXT” condition, various letters written within circle and square are activated. 10 Letters can be typed by single stroke and 40, by using two digits, one from those inside circle and one from those inside square. Thus this keyboard is capable of typing 10 + 40 = 50 letters of any language. This number can be further increased, if necessary.

02. The **<** and **>** keys move the cursor left-right and up-down.

03. The double-option key CAP / SMALL is used for typing Capital or ‘SMALL’, letters in case of English alphabet.

04. Other keys viz., ENTER, DEL, SPACE etc. have the conventional operations.

05. The REVERSE key is for language (like Arabic, Urdu etc.) that writes from Left to Right.

(iii) TYPING VARIOUS LANGUAGES :

It has been possible to prepare the above types of keyboards because of less number of keys. The concept of typing by using less number of keys was first conceived in SUS (Sarma's Unified Script). In this concept, proposal has been made for using digits representing various letters. It was shown that by using digits, it becomes possible to type any number of letters of a language by 'n' number of keys where " n = total number letters, divided by 5, plus 4". Thus while a language (say, English) having 26 letters needs 26 keys for typing, it would need only 6 + 4 = 10 keys if the letters are transformed into digits. Similarly a language with 52 scripts would need 11+4 = 15 and so on. If we place up to 12 number on the left, it will be possible to type languages having 12 X 5 + 4 = 64 letters or scripts. This number can be further increased by increasing the maximum number.

By following SUS principle, the letters of a language are assigned numbers in the following way.

(i) All letters and signs of the language are divided into groups of 5.

(ii) The first letter of each group is termed as the group head and these are represented by numbers, 1, 2, 3, 4, 5, 6 etc.

(iii) The remaining 4 letters of each group are given additional numbers like 1, 2, 3 and 4.

ENGLISH LANGUAGE :

Even though English alphabet has got 26 letters by pronunciation, it has got 52 writing scripts. However, in the conventional key board, the second or Capital version of the scripts are typed by using "SHIFT" key. In the proposed keyboard the CAP / SMALL key has been provided for its substitute.

Now we shall assign digital numbers to letters belonging to English language. Since 50% of the scripts are typed by using Shift (or CAP / SMALL) key, we have to assign numbers only to 26 letters. The numbers assigned to them have been shown in Figure No. 03 Numbering English letters.

Figure No. 03 Numbering English letters.

SMALL LETTERS - 26 nos.									
LETTER	**ASSIGNED NUMBER**	**LETTER**	**ASSIGNED NUMBER**	**LETTER**	**ASSIGNED NUMBER**	**LETTER**	**ASSIGNED NUMBER**	**LETTER**	**ASSIGNED NUMBER**
a	10	**b**	11	**c**	12	**d**	13	**e**	14
f	20	**g**	21	**h**	22	**i**	23	**j**	24
k	30	**l**	31	**m**	32	**n**	33	**o**	34
p	40	**q**	41	**r**	42	**s**	43	**t**	44
u	50	**v**	51	**w**	52	**x**	53	**y**	54
z	60								

The 0 shown within circle in the above keyboards in fact represents 10. But this one has been written as 0 because this number is also used in typing mathematical numbers. The numbering of letters follows such a simple and easy rule that it may need only a few days to remember. Keeping the above conversion chart at the beginning may be of additional help. It is now evident that whatever might be the appearance or number of the letters of any language, those can be assigned numbers easily by following the above principle.

BENGALI (and Sanskrit) LANGUAGE :
The essential letters of Bengali are 50, excluding of course the Vowel signs and combined letters. The vowel signs can also be spelt or pronounced by Vowel letters. Also the numerous combined letters can in fact be made by using 2 nos. of signs. In the proposed keyboard these signs have been shown as ‘CAP(+) and SMALL (-) in the navigation key. The numbers which can be assigned to 50 letters of Bengali have been shown in Figure No. 04 Numbering Bengali letters.

Figure No. 04 Numbering Bengali letters.

Consonants (40 nos) and assigned numbers									
LETTER	**NUMBER**	**LETTER**	**NUMBER**	**LETTER**	**NUMBER**	**LETTER**	**NUMBER**	**LETTER**	**NUMBER**
ক Ka	10	খ (Kha)	11	গ (Ga)	12	ঘ (Gha)	13	ঙ(Uma)	14
চ Cha	20	ছ(Chha)	21	জ (Ja)	22	ঝ (Jha)	23	ঞ(Yno)	24
ট Ta	30	ঠ (Tha)	31	ড (Da)	32	ঢ (Dha)	33	ণ (Na)	34
ত (no sound)	40	থ(no sound)	41	দ (no sound)	42	ধ(no sound)	43	ন (Na)	44
প (Pa)	50	ফ (Fa)	51	ব (Ba)	52	ভ (Va)	53	ম (Ma)	54
য (Ja)	60	র (Ra)	61	ড়(Rho)	62	ঢ় (no sound	63	ল (La)	64
য় (Ya)	70	স (Sa)	71	শ (Sha)	72	ষ (no sound	73	হ (Ha)	74
অ (o)	80	ক্ষ(no sound)	81	ৎ (no sound)	82	◌ঃ (no sound)	83	◌ঁ (no sound)	84

Vowel (10 nos.) and assigned numbers

LETTER	**NUMBER**	**LETTER**	**NUMBER**	**LETTER**	**NUMBER**	**LETTER**	**NUMBER**	**LETTER**	**NUMBER**

আ (A)	90	ই (I)	91	ঈ (Ee)	92	উ (U)	93	ঊ (Uu)	94
ঋ (Ri)	100	এ (E)	101	ঐ (Oi)	102	ও (O)	103	ঔ (Ou)	104

One great advantage of numbering Bengali and Sanskrit letters is, in their first education the children learn these languages in terms of five letters at one time.

ARABIC LANGUAGE :
In spite of their unusual type of appearances and the system of writing in the reverse way (i.e. from right to left), Arabic language can more easily be written through numbers. The principal reason is, the number of letters is 28, which is quite small. The numbers assigned to the Arabic letters have been shown in Figure No. 05 Numbering Arabic Letters.

Figure No. 05 Numbering Arabic Letters.

Letters (28 nos.) and assigned numbers									
NUMBER	LETTER	NUMBER	LETTER	NUMBER	LETTER	NUMBER	LETTER	NUMBER	LETTER
14	ج jīm	13	ث thā	12	ت tā	11	ب bā	10	ا alif
24	ر rā	23	ذ dhāl	22	د dāl	21	خ khā	20	ح ḥā
34	ض ḍād	33	ص ṣād	32	ش shīn	31	س sīn	30	ز zāy
44	ف fā	43	غ ghayn	42	ع ayn	41	ظ ẓā	40	ط ṭā
54	ن nūn	53	م mīm	52	ل lām	51	ك kāf	50	ق qāf
				62	ي yā	61	و waw	60	ه hā

After knowing the corresponding number of the letters of any language its typing is extremely easy. For digits which are multiples of 10 (i.e., 20, 30, 40 etc. a strike at the numbers on the left hand side is sufficient. For other numbers (like, 21, 23, 44 etc.), the left hand would press the specified number (1 to 0 or 12) and the right would strike one of the 4 digits inside the navigation key. The operation of the mobile phone is slightly different.

(iv) BRIEF COMPARISON BETWEEN TRADITIONAL AND SARMA KEYBOARD :
Let us make a brief comparison in between the Traditional and Sarma Keyboard on the basis of two criteria :

(i) Typing time and
(ii) Comfort of typing.

In both keyboards there are two types of typing, (a) Typing by One strike and (b) Typing by strike while another key is kept pressed. It is obvious that the first one is FAST and the second one, comparatively SLOW. In case of the second criterion, in between Typing by only fingers is easier and more efficient than that with movement of hands, wrists etc., where the hands need to move all across the length and breadth of the key board. It has been found that the area covered for typing in a standard laptop computer is about 22 cm X 30 cm. It is obvious that the less is this area the faster will be the typing.

The comparative picture of Typing-time and Comfort for three languages, English, Bengali and Arabic have been presented in Figure No. 06 Comparison of Typing Time of Keyboards.

Figure No. 06 Comparison of Typing-Time by two types of keyboards.

LANGUAGE	NO. OF LETTERS /SCRIPTS	(i) TYPING TIME				(ii) TYPING EASE AND EFFICIENCY		SUMMATION { (i) and (ii) }	
		(a) One strike		(b) Press & Strike		Traditional	Sarma	Traditional	Sarma
		Traditional	Sarma	Traditional	Sarma				
ENGLISH	52 (with shift key)	26 (50%)	06 (12%)	26 (50%)	46 (88%)	YES (100%)	YES (00%)	**25%**	**56 %**
BENGALI	50 +	26 (52%)	10 (20%)	24 (48%)	40 (80%)	YES (100%)	YES (00%)	**26%**	**60%**
ARABIC	28 +	26 (93%)	06 (22%)	02 (07%)	22 (78%)	YES (100%)	YES (00%)	**46%**	**61%**

(v) TRANSMISSION OF TEXTS :

At present various languages and texts are transmitted electronically in terms of the FONTS of the letters. The Fonts vary in shape and characters and full digitization is required for their transmission. When the job is to transmit the fonts of many languages it turns voluminous and hence cumbersome. It has been found that in the above principle most, if not all the languages can be transmitted through a single mode, which is number. The maximum numbers of Fonts, letters or characters to be transmitted in two different modes (viz. Font mode and Number mode) for the three languages mentioned above have been shown in Figure No. 07 Comparison of number of characters to be transmitted.

Figure No. 07 Comparison of number of characters to be transmitted.

LANGUAGE	NO. OF FONTS	NUMBER OF LETTERS TO BE TRANSMITTED					
		FONT MODE (Description)	NUMBER MODE (Description)	TOTAL			
				FOR THREE LANGUAGES (with 52, 50 and 28 letters)		FOR (SAY) 100 LANGUAGES (each with say, 52 fonts)	
				FONT MODE	DIGIT MODE	FONT MODE	DIGIT MODE
`ENGLISH	52	(From A to Z and a to z) = 52	(10-14, 20-24, 30-34, 40-44, 50-54, 60) X 2 = 52	**130**	**52**	**5,200**	**52**
BENGALI	50 +	(From ka to au) = 50	(10-14, 20-24, 30-34, 40-44, 50-54, 60-65, 70-74, 80-84, 90-94, 101-102) = 50				
ARABIC	28 +	(From Alif to Yeh)	(10-14, 20-24, 30-34,				

		= 28	40-44, 50-54, 60-62) = 28				

If this system is utilized by the experts responsible for transmitting fonts in internet, mobile phone and other communication gadgets, then instead of transmitting many fonts they can in fact transmit all languages in one mode (say, the digit mode) where the maximum number of fonts they would have to transmit would be equal to the number of fonts of the language having maximum number. For a great number of languages it may not exceed 70. After the local receiver (computer, mobile phone etc.) would receive this font, it can be converted to the desired font of the user by using locally installed software. It may save huge expenses of the concerned businessmen.

IDENTIFYING THE FONTS BY NUMBER :

From what has been discussed above, we can deduce that the Fonts belonging to various languages can now be identified in terms of numbers. Thus the first letter of any language will be identified by the number 10, the 10^{th} letter (it is the 4^{th} letter of group 2) by 2-4, or 24, the 48^{th} letter (it is the 3^{rd} letter of group 10) 10-3 or 103 etc. For quite a long period, we have been accustomed to seeing numbers associated with mathematics and calculation. For this reason some people may find such expression of letters through numbers quite problematic. The SUS script is a good solution to this problem. The SUS fonts have been designed in such a way that a simple look at any of these font reveal its group number and location in the group. So, it will be extremely easy for someone to identify any font in case the number representing the fonts are substituted by SUS fonts. SUS fonts can easily and efficiently be used as common media of transmitting of fonts.

CONCLUSION :

A key board becomes easy to operate and efficient in performance not only when it turns small, but it contains less number of keys. When various languages have letters ranging from 30 to 70, there remains no scope to create a keyboard with less number of keys. By applying the principle used in SUS it is however, possible to create keyboards with less number of keys. By SUS principle, the number of keys for typing fonts comes down to “number of fonts in the language divided by five, plus four” or say, slightly above $1/5^{th}$. In addition to reduction of keys, this system creates the scope for transmitting thousands of fonts belonging to many languages through a common media (by number or SUS font) having say, total 70 or 80 fonts. After transmitting various languages through a common font or “number”, those can then be reconverted in computer or mobile phone to the expected font through locally installed software. While a keyboard operable with fingers without movement of hand may be advantageous for those frequently using computers, it may also be advantageous for the mobile phone users manufacturers who look for a keyboard that may be placed in small space.

In this paper what has been presented is only the concept of the keyboard with less number of keys. The materialization of such a concept depends upon the joint efforts of the programmers, technologists and manufacturers of computer and mobile phone. In case the concerned experts and stakeholders find such a concept potential, useful, attractive and worthwhile, we are confident they would come forward for its materialization.

References :

01. Book 'SUS' FOR WRITING MULTIPLE LANGUAGES. Authors - Mira Sarma-Parai and Bijon B. Sarma. Published: 11/20/2009. ISBN: 978-1-42690-939-9. Publisher : Trafford Publishing Ltd., Canada.

02. "SUS", THE LATEST UNIFIED SCRIPT: POTENTIALITIES OF "SUS" IN MODERNIZING LANGUAGES. Authors : Prof. Bijon B. Sarma, Dr. Mira Rani Sarma Parai. Publisher: LAP LAMBERT Academic Publishing (August 15, 2010). Language: English. ISBN-10: 3838374118. ISBN-13: 978-3838374116.

03. "SUS" THE UNIFIED SCRIPT WITH A DIFFERENCE : Bijon B. Sarma. LAP Lambert Academic Publishing. ISBN 978-3-659-31132-1, Paperback, 104

THE END