E-learning : Web-based Accessibility Framework for Tamil Disabled

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ABSTRACT
E-learning could be a great tool that has contributed in facilitating education for individuals round the world. There's a necessity, however, for creating e-learning on the market to disabled individuals. This paper presents a web accessibility framework that offers the benefit of the web accessing for the Tamil disabled users and facilitates their long learning. The essential objective of this framework is that the support of the equal rights of Tamil disabled individuals for his or her access to the education and coaching.

Keywords
Tamil Moon code, Tamil language, Deaf, Deaf-blind, E-learning Interactivity, Moon code, web access , internet framework , Web System, WWW.

1. INTRODUCTION
The Web is providing new access to data and interaction for individuals with disabilities. Web accessibility primarily implies that individuals with disabilities will use the online. Additional specifically, web accessibility implies that individuals with disabilities will understand, navigate, and moves to the online [1]. And most web software system tools don't seem to be sufficiently accessible to individuals with disabilities, creating it tough or not possible for them to contribute to the online. This suggests that efforts area unit required to create a system that makes the online accessible particularly for the disables. There is a growing, worldwide recognition that users with disabilities have a constant right as others to access data technologies [2]. This paper proposes a web accessibility framework for the most sorts of the disabilities deaf-blind to facilitate the web accesses for the Tamil disabled. The proposed framework allows them to form use of the various websites with low efforts, low time and really low prices. The proposed framework depends on extracting the web site content via reading and analyzing the meta-language of any web page. Then the extracted content is given in an exceedingly format that matches the disabled user. The paper is structured as follows. Subsequent section presents the previous work that has been engineered for every kind of the disabilities. Section 3 presents the proposed web accessibility framework. Section 4 presents the proposed Tamil Moon code for the deaf-blind. Finally Section 5 summarizes the paper, and descriptions attainable avenue for future improvement.

2. RELATED WORK
Surveyed work drained [3] calculate the quantity of individuals with bound disabilities and "access" to the web. What "access" suggests that is ambiguous, though, by the researchers' own admission: It may merely mean a PC exists within the home or work which will be connected to the web or it may see active net use by the person in question. Even calculable regarding 45.3% of the world's population have some reasonably an incapacity in contrast, within the same survey, 56.7% of non-disabled individuals have net access. The inequality is respectable. [4]

The survey is classified as follows:

- Deafness Related Work: It contains the on the market accessibility systems that take care of the deaf persons.
- Deaf-Blindness Related Work: It contains the on the market accessibility systems that take care of the deaf-blind persons.
- Blindness Related Work: It contains the on the market accessibility systems that take care of the blind persons

2.1 Hearing loss Related Work
There is a unit four classes of that kind of survey supported the employment of this technique and also the user class that moves with it.

2.1.1 Interactive language Learning Systems
Khwaldeh et al in [5] proposed a centralized primarily based learning system, that aims to facilitate teaching and learning for each lecturer of the deaf and deaf individuals. This technique allows lecturers and unlistening move with one another. However this technique remains restricted in its use. In [6] Gennari et al given LOgic-based e-tool for DEaf kids (LODE) that aims at stimulating deaf kids to globally reason on narratives written in Italian. So elevation presents kids with e-stories and apt exercises that stimulate them to investigate the temporal relations between events, and to supply new relations in line with the story .But this

technique does not support the Tamil language because it supports solely the Italian language.

Kyun metric weight unit et al in [7] proposed an E-Learning framework that makes a typical platform for each traditional and disabled students which can share constant prestigious of their tutorial action. The deaf students will communicate with educator and different students with electronic communication over the chat-room system .But this technique want coaching on exploitation it and it does not support learning the SL generally.

To encourage the deaf kids to be told American Sign language (ASL), Shirali-Shahreza et al [8] proposed a system that is enforced exploitation PHP scripting language [9]. Once a handicapped person needs to enter an internet site that is formed for deaf persons, a word is shown as a show exploitation SL. The user ought to acknowledge the word and choose it from an inventory. If the user understands the SL and acknowledges the word, he/she will enter the website. This technique is not used for e-learning because it might be used for internet browsing. Another system is proposed in [10] that is an interactive program to show signs for K-3 arithmetic by 3D animation. However this technique is restricted for a special kind of courses and ages.

Straetz1 et al in [11] proposed a Learning Management System (LMS) that offers German SL videos in correspondence to each text within the learning surroundings. However it does not support the Tamil Sign Language (TSL). And Drigas et al in [12] given the same LMS except for Greek SL. The systems area unit designed notably for deaf adults World Health Organization wishes to keep up and improve their mathematics and reading/writing skills. These systems need a giant information measure for downloading videos. Therefore the dependableness of those systems is low.

Ohene-Djan et al [13] proposed a system, Kids Sign on-line (KSO) system, that is meant to show British Sign language (BSL) in cycle with English to deaf kids. However this technique supports a particular language BSL and does not support TSL.

Stewart et al in [14] proposed a library that's on the market on the signing browser website for teaching the signing. For every word, the "ASL Browser" website features a show an individual spoken language the word exploitation signing .The movies area unit in Quicktime [15] format. Though this technique supports a tiny low sized movies however its dependableness remains low.There area unit still limitations in developing e-learning applications that use the TSL for teaching deaf Tamil students, and also the already existent rare ones [16, 17] area unit missing interactivity between the user and also the system.

2.1.2 Content manufacturing System

In [18] Webducation software system Planungs- und EntwicklungsgmbH do a project in shutting cooperation with the Austrian Association for hearing impaired and deaf individuals (WITAF). The target of the project is to grant risk for unlistening generate and publish contents by themselves on the educational platform. Efthimiou et al in [19] proposed a platform surroundings that enables the event of varied academic applications accessible by deaf users for the Greek language (GSL).

2.1.3 Text-To-Sign Browsers

In [20] Boldyreff et al proposed a text-to-sign browsers for users of BSL. It's presently restricted in their use. One among the key issues is that BSL and signing don't translate word for word into English or vice-versa, as they need distinct grammars of their own, and so it'd be tough to translate a website directly .This type of systems is not on the market for TSL.

2.1.4 Online SL Dictionaries:

Dasgupta et al in [21] proposed a cross platform multilingual multimedia system Indian Sign Language (ISL) lexicon building tool. However; this technique does not give the TSL .Troelsgård & Kristoffersen in [22] proposed a Danish Sign Language (DaSL) lexicon. For signers World Health Organization have Danish sign language as their natural language, the lexicon can give data regarding Danish sign language like synonyms and variants. This lexicon could be a monolingual lexicon. Vettori et al in [23] given Electronic lexicon of Italian Sign Language (ISL) and Italian however it once more does not support TSL.

There is conjointly another e-LIS lexicon proposed in [24] that is that the internet bidirectional lexicon for Italian sign language-Italian. Mohandes in [25] proposes a system that interprets the Tamil text to Tamil language. Words that correspond to signs from the Tamil language lexicon calls a pre-recorded video clips showing the sign. If the word doesn't have a corresponding check in the language lexicon, it's finger spelled .But , this technique depends on the videos and , videos want an outsized information measure for downloading. Suzuki et al in [26] proposed a Japanese and Yankee language lexicon System for Japanese and English users. This lexicon once more does not support TSL.

The Online Sign Languages Dictionaries [27-37] represent important academic tools for the e-learning and coaching of Sign Languages. With the current direction several on-line dictionaries are developed for various Sign Languages. The bulk includes an outsized range of signs and targets at signers moreover as art students that learn an indication Language as a second language. Every sign is accompanied from the fabric and includes, on one aspect one translational equivalent and also the different aspect synonyms and antonyms within the language. All that dictionaries do not support the Tamil language.

2.2 Deaf-Blindness Related Work

It was the appearance of the non-public PC with Braille or increased visual output that opened opportunities for a big increase in access to data for deafblind individuals [38]. Software system for manufacturing giant characters on the monitor is comparatively cheap, however Braille displays have remained high-ticket. Since there's a shortage of skillful transcribers, the PC system area unit typically wont to translate text to shrink Braille that is then output on a special embosser [39].

The algorithms for this translation don't seem to be straightforward since the principles governing the employment of contractions depend upon pronunciation and that means. As an example, there's a contraction for

'mother' which might be used as a part of an extended word as long because it doesn't bridge a language unit boundary as in 'chemotherapy'. [39] The DOS text-based software is less complicated for several deafblind individuals than the ones, like Windows, that use a graphical computer program. But keeping to DOS restricts the selection of software system in this most new software system is written for the Windows surroundings [39]. But it's not recognizable to use the DOS within the existence of the online and also the web content. Over the years variety of systems are developed to emulate finger orthography since several deafblind individuals don't browse Braille. Hiroshi & Chikamune in [40] proposed a communication device that might facilitate the deaf-blind communicate with others World Health Organization don't understand the Braille or language. Though these devices work well in an exceedingly laboratory, there are issues in creating them typically on the market at reasonable costs.

Fu & atomic number 67 in [41] delineated a finger language recognition system for disabled aphasics, World Health Organization area unit able to categorical their intents solely by exploitation 'finger language'. Finger language is totally different from language within the sense that it's composed of straightforward hand gestures, every representing a predefined that means. The increasing use of graphics in writing books offers issues. Though several diagrams may be regenerated to a raised type, the method of reading by bit implies that a diagram needs to be haptically scanned and representation engineered of the entire diagram [39]. This is the other method for visual reading wherever one appearance in the image so reads the detail.

Years past independent agency [39, 42] had a drag with communication with astronauts throughout lift-off. The matter was of data overload exploitation visual and communication. Thus they investigated the employment of tactual communication; the project unsuccessful, however the analysis fashioned the idea of a reading aid for blind and deafblind persons systems to acknowledge written characters are developed for inputting text to computers. Such systems have immediate application for deafblind persons since the knowledge may be output in Braille [42].

2.3 A.I. Moon Code

Moon permits people that area unit blind or partly clear-sighted to browse by bit. It's a code of raising shapes and takes its name from its blind English discoverer [46].

1. There area unit several blessings for exploitation Moon code [42, 45] that area:

a. Moon provides an "active" reading technique for people that cannot access print - paying attention to audio books etc. is passive

b. Self study courses in Grade 1 and Grade 2 Moon area unit on the market from RNIB, sanctionative a would-be learner to form a begin albeit an educator isn't on the market

c. Moon is larger and also the characters area unit additional "open" than Braille, thus easier to feel and decipher

d. Moon needs a significantly less acute sense of bit than Braille, thus will generally facilitate readers with polygenic disorder whose finger sensitivity is reduced

e. Some kids and adults with learning and/or physical difficulties additionally to their visual impairments acquire some acquisition through Moon, wherever Braille would be not possible.

2. Depending on that Moon isn't wide known , there area unit some disadvantages [44-47] of it.

a. The alternative of Moon books on the market is extremely restricted nowadays.

b. There area unit presently no Moon magazines on the market, apart from deafblind readers.

c. There isn't any transportable, computer for writing Moon, that there's for Braille.

d. The range of Moon readers is low and declining.

e. Whereas a "soft Braille" show may be joined to a PC so as to understand what's on the screen, the Moon equivalent isn't on the market, that could be an explicit disadvantage to those that cannot use a speech package.

All of the on the market dedicated systems for deaf-blindness have some issues like high prices and have low dependableness. Overall , they can not take care of the Tamil language.

2.4 Blindness Related Work

There area unit several screen readers and screen magnifiers to assist the visually impaired as in [48; 49]. But all the on the market dedicated systems for blind user area unit terribly weak with the Tamil language and that they are not nominated for the Tamil web users. Consequently; men of science tried to unravel this drawback in a straightforward means within the proposed web accessibility framework as an analysis and style stages.

3. THE PROPOSED WEB ACCESSIBILITY FRAMEWORK FOR THE TAMIL DEAF-BLIND

The proposed system and every one of its parts work to supply the tutorial material for deaf-blind in an interactive means .The proposed system could be a 3-tier [50] system design which implies info retrieval & change , Application Logic and GUI presentation as shown in Figure 1.

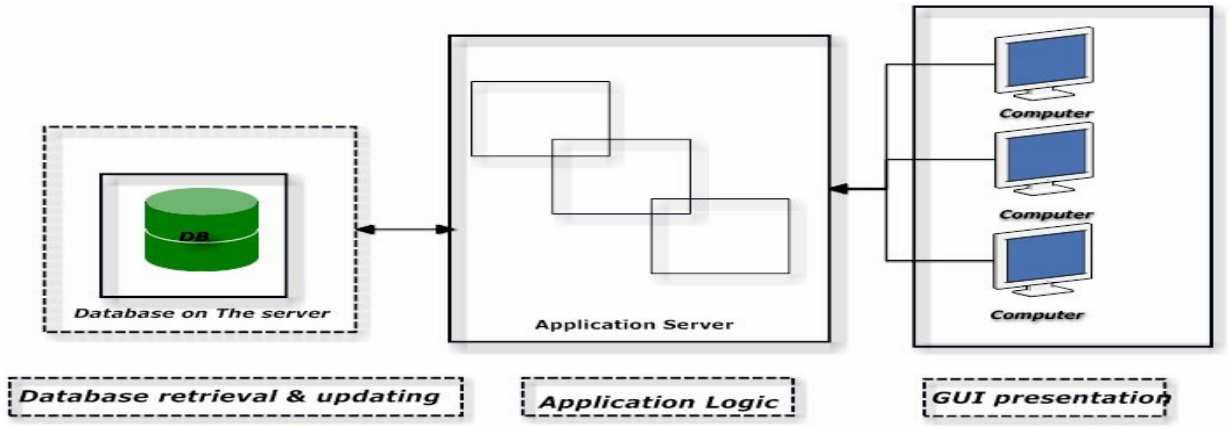


Figure 1: The 3-tier design of the proposed framework

Following area unit the proposed parts of the proposed framework as shown in Figure 2.

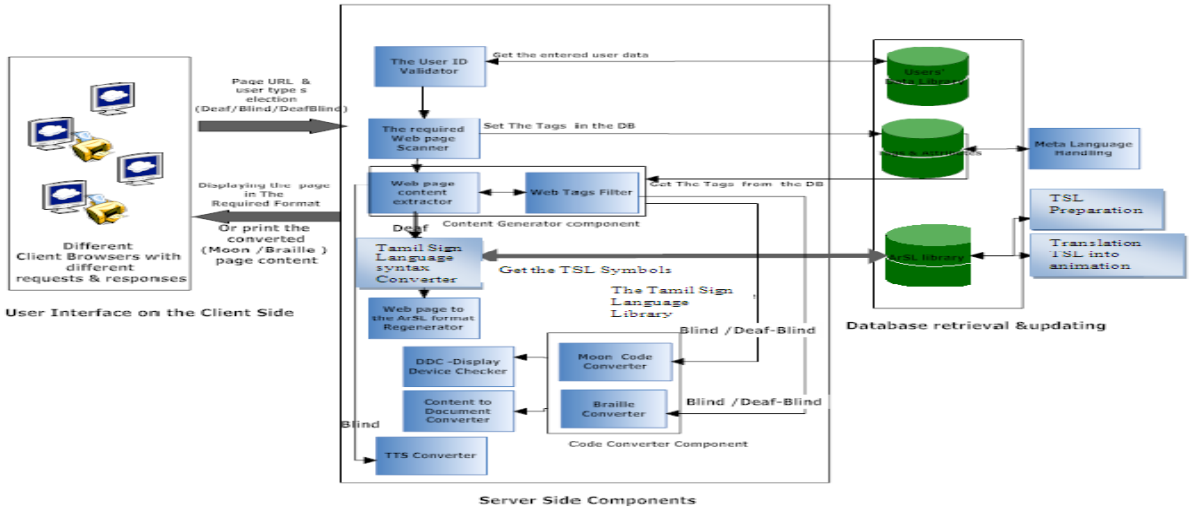


Figure 2: The diagram design of the proposed framework

3.1 The consumer aspect element

The User Interface: Through that the user access the system first he/she enters the desired universal resource locator then he/she select the kind of the incapacity (Deafness /Blindness /Deaf-Blindness). Then the request is processed though the server aspect parts and also the response area unit sent back to the user.

3.2 The Server aspect parts

3.2.1The User ID Validator : Checks the user's login data and establish the user's incapacity sort

3.2.2 Users' information Library : Contains all the user's data ; Name , password , e-mail address , incapacity sort , and ; if the user is blind ; blindness language (Braille /Moon) .

3.2.3The needed online page Scanner: it is the 1st element within the server aspect of the applying. It Opens the desired online page and scans the total content of it, so the scanned content is passed to the acceptable element.

3.2.4 Meta Language Handling: This module could be a summarization for the steps that man of science followed to be able to handle the meta-language of any online page.

3.2.5 The Tags Library : All the scanned tags from the online page area unit inserted in an exceedingly info to be processed later within the content generator element

3.2.6 The Page Content Generator: it's 2 subcomponents 1-Web page content extractor & 2-internet Tags Filter.

- The online page content extractor extracts the Tamil online page content.
- The internet Tags Filter element eliminates every tag within the extracted content and returns with solely the pure page content .Then it passes the extracted content to the acceptable next parts.

3.2.7 Tamil SL syntax device : interprets the desired internet page to the TSL obtaining the substitutable SL words from the TSL library

3.2.8 Tamil SL Library Preparation Module: The TSL is different from the Tamil language [25] neither in its vocabulary nor its synchronic linguistics. The primary demand to create the lexicon system was assembling the information needed to take care of the TSL consultants, specialists and reading totally different TSL references. The second step is obtaining a writing in an exceedingly specific field and applying the TSL information thereon. To induce the words which will be translated into TSL from any page, all the words should regenerate to their roots. Then the entire substitutable words should be declared . Then check for TSL substitutable existence.

The Translation of the TSL Words into Animations Module: once assembling the words which will be diagrammatic in TSL .The gestures of every word should be declared and keep in an exceedingly info with the corresponding word. Then the animation for every word is meant from the word gestures .Finally the animations area unit fixed within the information.

3.2.9 TSL library: This library contains of regarding 3500 Tamil gestures like the foremost common Tamil words [51] .Then the output of the TSL syntax device is passed to the acceptable element.

• Web page to the TSL format Regenerator: This element converts the signs to AN adequate format for the online, by creating the online page content with its tags once more.

3.2.10 Text To Speech (TTS) converter: TTS are AN external service that's used inside the framework. (If the user could be a blind) he/she will choose whether or not the page is spoken loudly It converts the page content of speech. (Note: There still some issues in changing the text in some languages like Tamil and Farsi [38, 51] or not.

3.2.11 Code device: It takes the user elect blind-language (Braille or Moon) as AN input ANd gets the suitable one as an output.

o **Moon Code Converter*:*** It converts the online page content to Moon code.

Braille device : : It converts the online page content to Moon code

3.2.12 Show Device Checker (DDC): If the Display Device (DD) is chosen to show the output on AN adequate device; the DDC checks if the acceptable show device (Braille show device or Moon show device) is obstructed to the PC or not .If it's obstructed, the output is transferred thereto .If there's no device plugged; a special error message can seem it's going to be a spoken error message for the blind user and might be perceived as vibrates for the Deaf-Blind one.

3.1.13 Content to Document device : : It takes its input from the (Moon code /Braille) device module and build a document on the fly that contains the online website content in an exceedingly descriptive type.

If the user either a blind or deaf-blind, he/she will choose one among the 2 alternatives –if the speaking the page loudly wasn't selected-the kind of the output language, Braille or Moon code, (But there's still a drag, there's no special show device for moon characters) and choose whether or not the output is on a Braille /Moon showing device or in an exceedingly document to be written with a special embosser later.

4. THE PROPOSED TAMIL MOON CODE

Authors baby-faced the matter with however will they create the Tamil websites accessible for the Tamil deaf-blind persons. They studied all the on the market communication strategies for the deafblind individuals. Depending on that study and finding out the benefits of the Moon language that was mentioned within the section 2.2.1, authors engineered a brand new Moon code font for Tamil alphabets TimesMoon. They engineered TimesMoon looking at the formation of the Times New Roman font. The reading technique for this code are from the proper to the left as Tamil , so that the Tamil deafblind user will not face issues with reading his/her mother language. Then authors used the TimesMoon font within the proposed framework

Tables 1, 2 show the TimesMoon alphabet and its Unicode that correspond to every Tamil letter

Table 1, The alphabet in Tamil Moon (TimesMoon)

Various signs
0B82 ஂ TAMIL SIGN ANUSVARA
• not used in Tamil
0B83 ஃ TAMIL SIGN VISARGA
– aytham

Independent vowels
0B85 அ TAMIL LETTER A
0B86 ஆ TAMIL LETTER AA
0B87 இ TAMIL LETTER I
0B88 ஈ TAMIL LETTER II
0B89 உ TAMIL LETTER U
0B8A ஊ TAMIL LETTER UU
0B8B <reserved>
0B8C <reserved>
0B8D <reserved>
0B8E எ TAMIL LETTER E
0B8F ஏ TAMIL LETTER EE
0B90 ஐ TAMIL LETTER AI
0B91 <reserved>
0B92 ஒ TAMIL LETTER O
0B93 ஓ TAMIL LETTER OO
0B94 ஔ TAMIL LETTER AU
= 0B92 ஒ 0BD7 ◌ௗ

Consonants
0B95 க TAMIL LETTER KA
0B96 <reserved>
0B97 <reserved>
0B98 <reserved>
0B99 ங TAMIL LETTER NGA
0B9A ச TAMIL LETTER CA
0B9B <reserved>
0B9C ஜ TAMIL LETTER JA
0B9D <reserved>
0B9E ஞ TAMIL LETTER NYA
0B9F ட TAMIL LETTER TTA
0BA0 <reserved>
0BA1 <reserved>
0BA2 <reserved>
0BA3 ண TAMIL LETTER NNA
0BA4 த TAMIL LETTER TA
0BA5 <reserved>
0BA6 <reserved>
0BA7 <reserved>
0BA8 ந TAMIL LETTER NA
0BA9 ன TAMIL LETTER NNNA
0BAA ப TAMIL LETTER PA
0BAB <reserved>
0BAC <reserved>
0BAD <reserved>
0BAE ம TAMIL LETTER MA
0BAF ய TAMIL LETTER YA
0BB0 ர TAMIL LETTER RA
0BB1 ற TAMIL LETTER RRA
0BB2 ல TAMIL LETTER LA
0BB3 ள TAMIL LETTER LLA
0BB4 ழ TAMIL LETTER LLLA
0BB5 வ TAMIL LETTER VA
0BB6 ஶ TAMIL LETTER SHA
0BB7 ஷ TAMIL LETTER SSA
0BB8 ஸ TAMIL LETTER SA
0BB9 ஹ TAMIL LETTER HA

Dependent vowel signs
0BBE ◌ா TAMIL VOWEL SIGN AA
0BBF ◌ி TAMIL VOWEL SIGN I
0BC0 ◌ீ TAMIL VOWEL SIGN II
0BC1 ◌ு TAMIL VOWEL SIGN U
0BC2 ◌ூ TAMIL VOWEL SIGN UU
0BC3 <reserved>
0BC4 <reserved>
0BC5 <reserved>
0BC6 ◌ெ TAMIL VOWEL SIGN E
• stands to the left of the consonant
0BC7 ◌ே TAMIL VOWEL SIGN EE
• stands to the left of the consonant
0BC8 ◌ை TAMIL VOWEL SIGN AI
• stands to the left of the consonant

Two-part dependent vowel signs
These vowel signs have glyph pieces which stand on both sides of the consonant; they follow the consonant in logical order, and should be handled as a unit for most processing.
0BCA ◌ொ TAMIL VOWEL SIGN O
= 0BC6 ◌ெ 0BBE ◌ா
0BCB ◌ோ TAMIL VOWEL SIGN OO
= 0BC7 ◌ே 0BBE ◌ா
0BCC ◌ௌ TAMIL VOWEL SIGN AU
= 0BC6 ◌ெ 0BD7 ◌ௗ

Virama
0BCD ◌் TAMIL SIGN VIRAMA

Various signs
0BD0 ௐ TAMIL OM
0BD1 <reserved>
0BD2 <reserved>
0BD3 <reserved>
0BD4 <reserved>
0BD5 <reserved>
0BD6 <reserved>
0BD7 ◌ௗ TAMIL AU LENGTH MARK

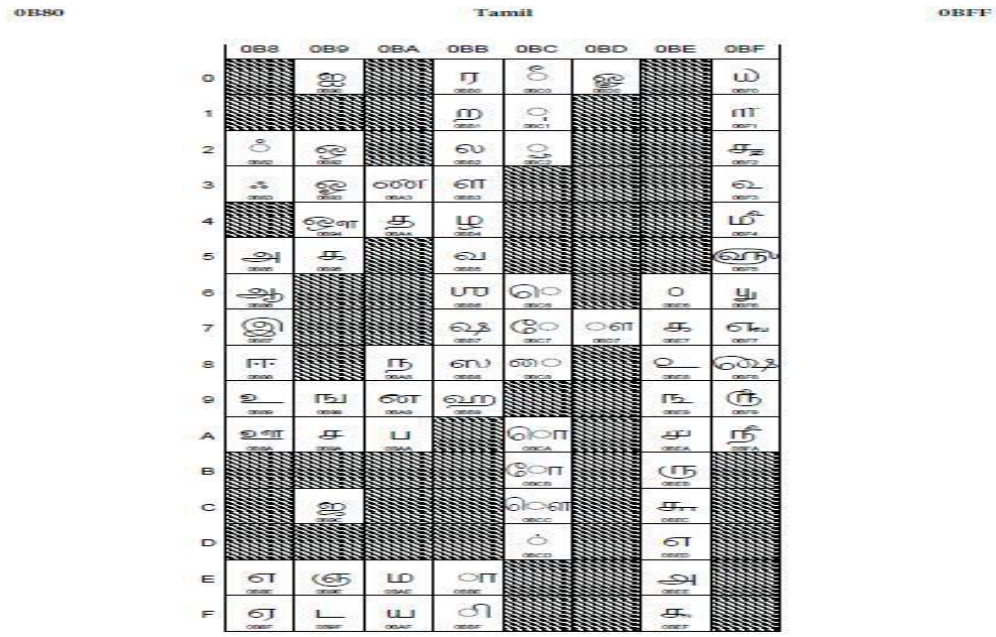
Reserved
For viram punctuation, use the generic Indic 0964 and 0965.
0BE4 <reserved>
— 0964 । devanagari danda
0BE5 <reserved>
— 0965 ॥ devanagari double danda

Digits
0BE6 ௦ TAMIL DIGIT ZERO
0BE7 ௧ TAMIL DIGIT ONE
0BE8 ௨ TAMIL DIGIT TWO
0BE9 ௩ TAMIL DIGIT THREE
0BEA ௪ TAMIL DIGIT FOUR
0BEB ௫ TAMIL DIGIT FIVE
0BEC ௬ TAMIL DIGIT SIX
0BED ௭ TAMIL DIGIT SEVEN
0BEE ௮ TAMIL DIGIT EIGHT
0BEF ௯ TAMIL DIGIT NINE

Tamil numerics
0BF0 ௰ TAMIL NUMBER TEN
0BF1 ௱ TAMIL NUMBER ONE HUNDRED
0BF2 ௲ TAMIL NUMBER ONE THOUSAND

Table 2 The numbers in Tamil Moon (TimesMoon)

0B80 Tamil 0BFF



5. CONCLUSION AND FUTURE WORK

This paper has been given a We-based accessibility framework for the disabled Tamil students. The proposed framework deals with 3 sorts of the disabilities: hearing loss, blindness and deaf-blindness. It depends on extracting the web site content via reading and analyzing

the meta-language of the web page, then the extracted content is given in an exceedingly format that matches the present disabled user; written Moon code for the deaf-blind users, TSL animations for the deaf users or speech for the blind users. Also a proposed e-learning system for the deaf Tamil students has been given. This technique depends on the TSL animated library. This library consists of every Tamil word and also the corresponding TSL designed animation. The animations designed for this purpose area unit terribly reliable; as they're Very light animated GIFs. Though the opposite existing BSL or signing libraries looking at videos. Thus this library has more blessings than the other existing one. Also this paper has been given proposed style in the Tamil Moon code for the deaf-blind Tamils. Moreover, it's given a survey on the online accessibility construct and definitions, goals and also the current applied internet accessibility systems with the execs and cons of them.

As always, there's an area for added improvement. Any areas of analysis that are known warranting further investigation are:

• This work is meant to be enclosed in an exceedingly Quality Assurance program dedicated to the disabled Tamil students. To grant them their rights at the opposite students in sensible education.

• Implementing the proposed framework as an entire system and publish it online for all the Tamils disabled as a result of the proposed framework could be an epitome level.

• Improving the system to browse any material revealed on the online.

• Improving the TSL animated library so the deaf user will select the well-liked avatar.

• Designing and building the TSL library with an icon maker for additional dependableness.

• Building a Tamil chat space dedicated for Tamil deaf persons.

• Building a web-based Tamil TTS library to enhance the Blind module performance.

• Expanding the e-learning system for deaf Tamil students with building a test management system dedicated to them.

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