

# Tutorial for Deaf – Teaching Punjabi Alphabet using Synthetic Animations

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## Abstract

Developing an automatic tool for educating students has become essential in today's world of computerization. For differently abled people, especially in India, where the resources are scarce for educating them, it becomes essential to develop such technologies which give the opportunity to each and every individual to get the education online and free of cost. Research work has been done to create HamNoSys notation of at least two words corresponding to each alphabet of Punjabi Language. The HamNoSys notation when used in JASigning animation tool produces the synthetic animation. The synthetic animations are better as compared to human videos in terms of memory requirement, standardization, and flexibility. Synthetic animations can be modified as per the requirement whereas the human videos cannot be modified. The only drawback that seems is, these synthetic animations may lack the natural non-manual component of sign. The research work has been incorporated to produce the web portal that displays the Punjabi alphabet along with the picture related to that alphabet and the synthetic animation with which that word is signed in Indian Sign Language. The work is the first of its kind for Indian Sign Language.

**Keywords** Indian Sign Language, HamNoSys, SiGML, Punjabi Alphabet, Synthetic Animation

## 1 Introduction

Sign language is the visual spatial language which is used by the differently abled hearing impaired people to communicate. Sign Language is the three dimensional language which uses the 3D space around the signer's body using its hands, arms, body postures, face expressions, and head movements.

Among approximately 7105 known living languages worldwide, there are 141 Sign Languages depending upon the region in the world. There are nearly 72 million people who are hearing impaired among nearly 7 billion people on earth. The situation is worst as 90% of

these differently abled people have very limited or no access to education and other information. [1][2].

In India, situation is worse; there are 5072914 persons who suffer from hearing disability. Among them, only 546826 hearing impaired persons are literate below primary education [3] which accounts for only 10.78%.

Sign language is different for different countries/regions as this language is not created but it is evolved by deaf people. So, depending on the region, the signs are different as well as the grammar is also different depending on the region. As far as Indian Sign Language is concerned, it is categorized in manual and non-manual signs which may be static signs or dynamic signs. Static signs are those signs which do not have any movement in their signs. The dynamic signs are those which use the movement of the hands, and the non-manual features of the sign. Most of the signs used in the Sign Language are dynamic signs.

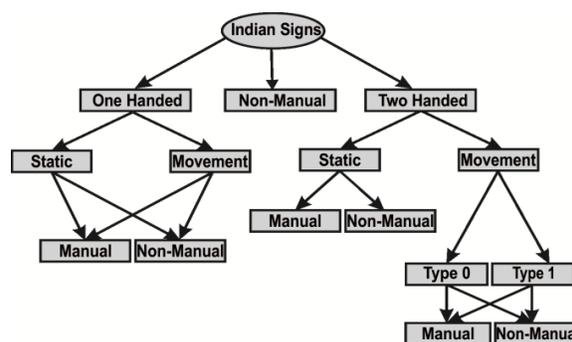


Figure 1: ISL Type Hierarchy

The one handed signs are represented by a single dominating hand whereas the two handed signs are represented by both the hands of the signer.

Both one handed as well as two handed signs can be either static or dynamic (having movements). Each of the static and movement signs is further classified into manual and non-manual signs.

Two handed signs with movements can be further distinguished as: Type0 and Type1 signs. **Type0** signs are those signs in which both the hands are active i.e. both the hands are in motion. **Type1** signs are those signs in which one hand (dominant) is more active as compared to the other hand (non-dominant).

## 2 Review of Literature

The education is essential for the good social life. The hearing impaired persons also required to be educated so that they can communicate with each other in their own language as well as capable of communicating in their social life. In India, various schools are available to impart education to these people but these schools are limited to only urban areas. Even the number of schools is scarce in urban area. A lot of hearing impaired persons have no access of education and so they are cut off from the society.

A lot of work has been done in implementation of sign language dictionary worldwide. Dictionaries have been created in the form of books which are obsolete in this day and age of computerization. Video dictionaries are available for sign languages of many countries like America, Britain, Australia, Spain, Italy, and even India. These video dictionaries can be categorized as real character (human being) producing the sign or computer generated animated character (avatar) producing the sign. A lot of Indian sign language dictionaries are available which uses the real human being producing the sign for an English word. No Indian sign language dictionary is available which uses computer generated character (avatar) technology.

- The Ramakrishna Mission collaborated with CBM International, Germany for a project on sign language dictionary in year January 1999. The goal for the project was to standardize Indian Sign Language. On November 24, 2001, the first Indian Sign Language dictionary was released which

contains more than 2500 signs. These signs were taken from 42 cities in 12 States to provide a common sign language all over India[4]. The signs in this online dictionary are videos of real human English Alphabets are also included in the sign dictionary. This dictionary does not contains any other languages of India even Hindi alphabets are not included.

- Spread the Sign, an international project by Leonardo da Vinci supported by the European Commission through the Swedish International Program Office of Education and Training. The goal of this project is to share various sign languages from different countries over the internet. The drawback of this work is that it has videos for the words rather than animations which take a long time to load as compared to synthetic animations [5]. The participation of various countries is not upto the mark.
- Handspeak created is the American Sign Language dictionary. The dictionary is released on the domain handspeak.com in 2000. The website contains the ASL signs, some variants of ASL signs, some verb inflections, and more. The dictionary is produced and signed by native ASL bilinguals [6].
- Sign Smith [7] is a 3D illustrated dictionary of ASL. It is used as educational software for the hearing impaired people of America. It is also an authoring tool to create ASL content.

A lot of work is done in developing the dictionaries of sign language of various countries but no work has been found in developing the dictionary or tutorial for teaching the Punjabi (Language of the state Punjab) alphabet.

## 3 Punjabi Alphabet

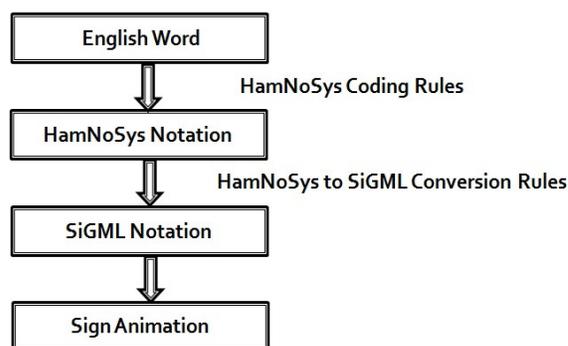
Punjabi is one of the 22 official languages of India which is spoken in the state of Punjab. In India, Punjabi is written in Gurmukhi alphabet which is composed of vowels, consonants, vowel diacritics.

The vowels and vowel diacritics are known as Laga Matra where as consonants are known as Vianjans. In Gurmukhi alphabet, there are a total of 10 vowels, 10 vowel diacritics and 41 consonants.





Alphabet and corresponding word), a picture of the word is also displayed. The animation is produced in ISL describing how to produce the sign for each word. For each Punjabi alphabet, we have chosen two word for better understandability. For a total of 31 alphabets, we have created HamNoSys code for 61 words. HamNoSys has an alphabet of about 200 symbols (Unicode of this notation system is available) which covers almost all the hand shapes, hand location, hand/palm orientation, hand movement, and non-manual parts of the sign. Later this HamNoSys can be converted into SiGML (Signing Gesture Markup Language) tags which are sort of XML tags that can be animated by an animation tool using an Avatar. The sequence of steps for creating the animation from English word is as shown in the following architecture [10]:



**Figure 5: Architecture to Produce the Animation from English Word**

All the 61 signs are dynamic signs except the sign of word **ਨੱਕ** (nose) which is static single handed sign. Below table shows the list of words corresponding to each Punjabi alphabet.

**Table 2: Words with each Alphabet coded in HamNoSys**

S.No.	Punjabi Alphabet	Words
1	ੳ	ਉਠ, ਉਗਲੀ
2	ਅ	ਅੱਖ, ਅੰਬ
3	ੲ	ਇੱਲ, ਇੰਜਣ
4	ਸ	ਸੇਬ, ਸੰਤਰਾ
5	ਹ	ਹਾਥੀ, ਹਿਰਨ
6	ਕ	ਕੇਕ, ਕੱਤਾ
7	ਖ	ਖਿੜਕੀ, ਖੰਬ
8	ਗ	ਗਾਂ, ਗੈਂਡਾ

9	ਘ	ਘਰ, ਘੋੜਾ
10	ਚ	ਚੰਨ, ਚਿੜੀ
11	ਛ	ਛੱਤਰੀ, ਛੱਲਾ
12	ਜ	ਜਹਾਜ, ਜੰਗਲ
13	ੜ	ੜੰਡਾ, ੜਰਨਾ
14	ਟ	ਟਾਰਚ, ਟੈਕਰੀ
15	ਠ	ਠੇਲਾ, ਠੰਡ
16	ਡ	ਡੱਡੂ, ਡੱਬਾ
17	ਢ	ਢੇਲ, ਢਾਲ
18	ਤ	ਤਿੱਤਲੀ, ਤਰਬੂਜ
19	ਥ	ਥਾਲੀ, ਥੈਲਾ
20	ਦ	ਦੰਦ, ਦਰਖਤ
21	ਧ	ਧਰਤੀ, ਧਾਗਾ
22	ਨ	ਨੱਕ, ਨਾਰੀਅਲ
23	ਪ	ਪੁਤੰਗ, ਪਾਣੀ
24	ਫ	ਫੁੱਲ, ਫਲ
25	ਬ	ਬੈਲਗੱਡੀ, ਬਤਖ
26	ਭ	ਭੇੜੀਆ, ਭਾਲੂ
27	ਮ	ਮੱਖਣ, ਮਛਲੀ
28	ਯ	ਯੋਗ
29	ਰ	ਰੇਲ, ਰਾਤ
30	ਲ	ਲੇਮੜੀ, ਲੜਕੀ
31	ਵ	ਵਾਲ, ਵਰਖਾ



**Figure 6 : Screenshot of the Punjabi Alphabet Tutorial**

## 7. Conclusion

Automatic tool for learning Punjabi Alphabet by the hearing impaired people is challenging task because creation of synthetic animation for all the words corresponding to Punjabi alphabets is very difficult to create. This paper represents the creation of synthetic animations using HamNoSys notation for 61 words for all the Punjabi alphabet. All the synthetic animations are incorporated in the web portal. The present work is important for hearing impaired people

because of scarce resources like deaf schools in India. The tool can be very much beneficial for imparting education to these differently abled people.

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