

# HamNoSys for Indian Sign Language

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## ABSTRACT

Sign Language is very important for deaf and dumb people as a mode of communication. They learn sign language as their mother tongue. Research work on Indian sign language is very limited. The reason behind lack of research is that there is no proper grammar of ISL and sign language is not universal around the world. As we know that sign language vary from country to country so signs are different in every country. One tool named as ESigneditor contains HamNoSys corresponding to words. This tool stores HamNoSys for 200 words based on German sign language. In this paper, I have generated HamNoSys for words according to the Indian sign language. To check the accuracy of these notations, JA SiGML Client APP and JA SiGML Service Player APP are used. Results of these notations with the help of animation APPs are tested manually with the help of "Indian Sign Language Dictionary" and results are very encouraging.

## Keywords

Indian Sign Language, HamNoSys, Sign language animation system, SiGML, ASL

## 1. INTRODUCTION

India is 2<sup>nd</sup> largest country in Population. As the population increases number of disable persons also increases. One survey was conducted and it was revealed that around 4 million deaf people and more than 10 million hearing-impaired peoples are in India [4]. India has more hearing-impaired people than other countries but development of Indian Sign Language is very limited. According to the survey only 5% people get education in India [9]. Indian Sign Language is not yet used by most of the deaf communities. This is major challenge in front of sign language linguists. Sign language interpreters are very limited in India so it is very difficult to provide knowledge of signs to deaf and dumb people. Most of the hearing-impaired people use their hands and arms to convey messages to each other without having knowledge of sign language. So to overcome this problem we need software so that hearing-impaired people can easily learn sign language. In India, to educate the deaf and dumb people sign language experts are needed. It is very difficult to find such experts because a hearing-impaired person does not have chance to get proper education based on signs. Schools for deaf and dumb people are also very limited.

Normal people never even tried to learn sign language and the main reason behind it normal people think that deaf and dumb people are punished for their sins. For this reason they even don't like to talk with them, deaf and dumb people are always demoralized by the hearing people. Government also does not provide as much support for these communities. In 21<sup>st</sup> century the bridge gap between hearing-impaired and normal people reduces. As people get education they understood that the disability is not any kind of punishment for sins. They have started to talk with them; they feel sympathy for them and most important thing that hearing-impaired people get respect in society. There are large numbers of software developed to learn sign language. One easiest way to learn sign language is sign language generation system with the help of video clips. There are many software has been developed based on this method. This method has some disadvantages explained as: it requires large memory in the user system, video clips are also very expensive, it is very time consuming also. Sign language animation generation system has more advantageous than video generation system so it has been more used and preferred now days. Animation generation system also provides 3D visualization which helps to easily understand the signs from every point of view.

This paper has been divided into 6 sections. 1 section contains the Introduction of Indian sign language. Section 2 describes related work in Indian sign language. Section 3 describes Resources needed in detail. Section 4 shows Results and Discussion. Section 5 describes proposed system. Conclusion and future scope described in section 6.

## 2. RELATED WORK

Rupinder Kaur has developed a HamNoSys Generation System that helps to the animation process. This tool has been developed for Indian Sign Language [7]. This system has same functionality as the ESigneditor have. This system store 200 words same as ESigneditor. This system provides searching criteria for words. This tool saves HamNoSys corresponding to the words into its database.

Jing Wang and his colleagues [6] have developed a Chinese Sign Language Animation System on Mobile Devices for the deaf and dumb people. This system has three models: 3D virtual human model, word segment

based on Chinese sign and rendering. Virtual human model is animation tool used to display animation on screen. Chinese –oriented semantic analysis algorithm is used in this system [3]. This algorithm helps to segment the Chinese text to set of sign words. To generate animation sign data is very necessary. This system stores this sign data into RAM. It saves seeking and tracking time because sign data is easily available in memory of the system. The term rendering helps to display the animation on the screen. In this system they have developed their own avatar named as blue-Jane. Blue-Jane avatar is composed of different sub-models according to sign motion but it takes more time to display animation on screen and does not display animation in continuous interval. So to overcome this problem they used another rendering technique called double buffer based fast rendering. According to this technique current frame displays in foreground buffer on screen, at the same time it displays next frame to the background buffer. When the current frame displayed on the screen then the foreground and background buffer is swapped. This method reduces the display time on the screen.

Yoshinao Aoki and his colleagues have developed a sign language communication between Japanese-Korean and Japanese –Portuguese using CG animation system that help the deaf and mute people of different region to communicate with each other [1]. In this paper they have focused on analysis of images of sign language, generation of sign language images corresponding to the meaning of sign language and display it on the screen. They have developed a system that translates text into sign language images. This system helps to generate sign language animation very easily. They used MATLAB to produce animation but while testing they found it takes more time to generate animation. Therefore they have developed a system using LIFO language.

### 3. RESOURCES NEEDED

#### 3.1 HAMNOSYS

HamNoSys stands for Hamburg Notation System is a notation system used to give written form to sign language. It was developed in 1980s at the University of Hamburg. It describes signs in form of signing parameters. Parameters are: hand shape, hand orientation, hand location and hand movement [7]. Hand shape describes the basic shapes of hands, fingers and also includes hand bending. Hand orientation include all possible views of hand such as top view, front view etc. Hand location includes detail of head, pair location, mouth, trunk and lower extremities. Hand movements include all movements of hand. It is very difficult to remember these notations because these are very different notations. It requires any sign language expert to remember these notations but in India it is difficult to find such person. So to overcome this

problem many tools have been developed that store HamNoSys corresponding to words. These tools are: ESigneditor. ESigneditor is a tool developed in German for German sign language [14]. It was released in three languages: German, English and French. This tool stores HamNoSys corresponding to words in its database. This tool store notations based on German sign language. It provides search criteria to find HamNoSys corresponding to any word. This tool is quite helpful to generate HamNoSys in any other sign language. Figure 1 shows the notations for word “Abuse” according to Indian Sign Language.



Figure.1.HamNoSys for word “Abuse”

#### 3.2 SiGML

SiGML, the signing gesture markup language was developed during the ViSiCAST project to represent the HamNoSys in coding form so that the computer can easily understand it to generate animation of particular word. SiGML is based on XML specification but the structure is very simple rather than XML. SiGML is supported by the JA SIGNING Avatars, SiGML easily readable by avatars in order to generate animation [15]. Initially SiGML was categorized into two types: “HamNoSysML” was firstly used to represent HamNoSys. Later it was renamed as hns-SiGML, John Glauert named it as H-SiGML. Figure 2 shows the evolution of SiGML.

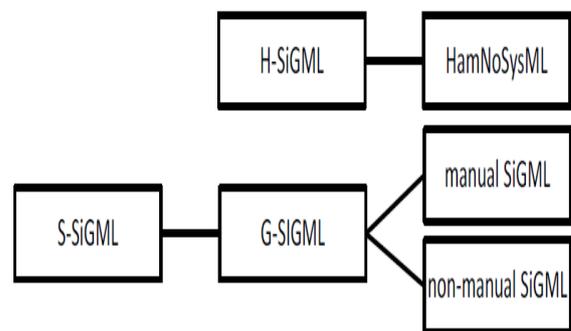


Figure.2. Evolution of SiGML [10]

H-SiGML was developed to represent HamNoSys in human readable format. H-SiGML was very lengthy and it did not contain valuable information for the avatar. So to resolve this problem it needs firstly converted into G-SiGML. G-SiGML stands for “Gestural” SiGML and also referred as SiGML. G-SiGML contains both manual and non-manual SiGML. Figure 3 shows SiGML for word “Abuse” based on Indian sign language.

```
<sigml>
  <hns_sign gloss="ABUSE"
">
    <hamnosys_manual>
      <hamfinger23spread/>
      <hamextfingeru1/>
      <hambetween/>
      <hamextfingeru/>
      <hampalmdl/>
      <hamnose/>
      <hamtouch/>
      <hammoveo/>
      <hamlargemod/>
    </hamnosys_manual>
  </hns_sign>
</sigml>
```

Figure.3. SiGML for word “Abuse”

#### 4. PROPOSED WORK

HamNoSys is very important for generating animation. HamNoSys is used to give written form to sign language. These notations are further converted into SiGML to produce animation. In our proposed work, I am taking initiative to develop a system that take input into Punjabi word and generate its animation with the help of JA SiGML SERVICE PLAYER APP. Figure 12 shows flow chart of proposed work.

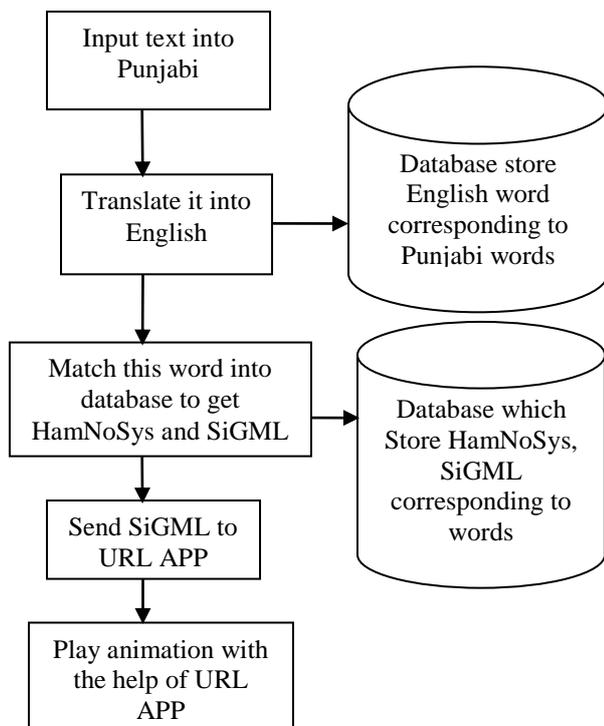


Figure.12. Methodology of proposed work

As shown in figure 12, input will be texted by the user in Punjabi. Punjabi word will be translated into English word with the help of database. Then SiGML will be retrieved from database where SiGML stored corresponding to word. SiGML is given to JA SiGML

APP to generate animation. After getting SiGML, URL APP will animate sign corresponding to word and display it on screen.

#### 5. RESULTS AND DISCUSSION

As we know that in India only few percent of deaf and dumb people get education. So they are unable to communicate with each other and a normal person also does not know sign language. Normal people feel difficulties to communicate with disable people. This is the main reason for gap between disable and normal people. In India, research on sign language is very limited. After reviewing the current research on Indian Sign Language we can say that it is very difficult to provide a written form to sign language without HamNoSys notations. These notations help the researchers to generate animations. HamNoSys also help to generate SiGML corresponding to words. To generate Sign language animation, SiGML is required. SiGML is used to represent HamNoSys in coding form so that it can be easily understood by virtual avatar. ESigneditor is a tool for German sign language which store HamNoSys and SiGML corresponding to words and it contain HamNoSys only for 200 words. Signs used in India are different than the signs used in German. In this paper, I have generated HamNoSys corresponding to words according to the signs used in India. I have generated HamNoSys with the help of tool named as: HamNoSys2HPSG and then generate SiGML corresponding to HamNoSys. This tool provides the HamNoSys key chart which contains token corresponding to every symbol. It helps to generate SiGML. I have generated HamNoSys corresponding to those words which are in most general use. The results of this system help to generate animation for words. To check its accuracy I have tested these notations with the help of JA SiGML Service player and JA SiGML Client APPs. Figure 4 and 5 shows HamNoSys for word “Mother” and its corresponding SiGML in Indian Sign Language.



Figure.4. HamNoSys for word “Mother” in ISL

```
<sigml>
  <hns_sign gloss="MOTHER">
    <hamnosys_manual>
      <hamfinger2/>
      <hamextfingeru1/>
      <hampalmdl/>
      <hamnose/>
      <hamlrat/>
      <hamtouch/>
    </hamnosys_manual>
  </hns_sign>
</sigml>
```

Figure.5. SiGML for “Mother”

Figure 6 and 7 shows snapshot of testing the HamNoSys with the help of tools for word “Mother” in Indian Sign Language. Accuracy of these notations can be checked by the animation because if the sign is correct then the HamNoSys is also correct. In this figure, animation is generated with the help of JA SiGML Client APP and JA SiGML SERVICE PLAYER APP. From Client APP, SiGML sends to URL APP and avatar name is “Anna” performing animation for specific word.

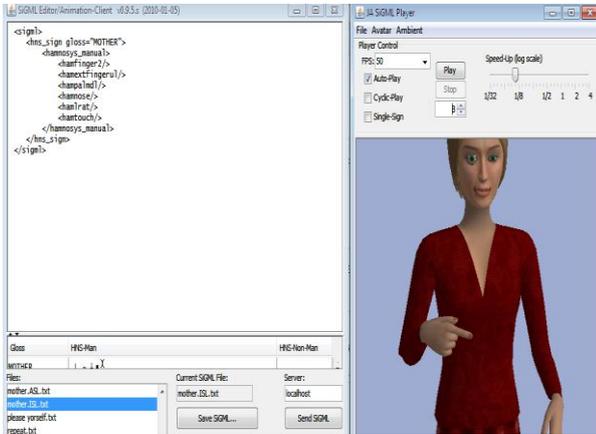


Figure.6. sign for word “Mother”

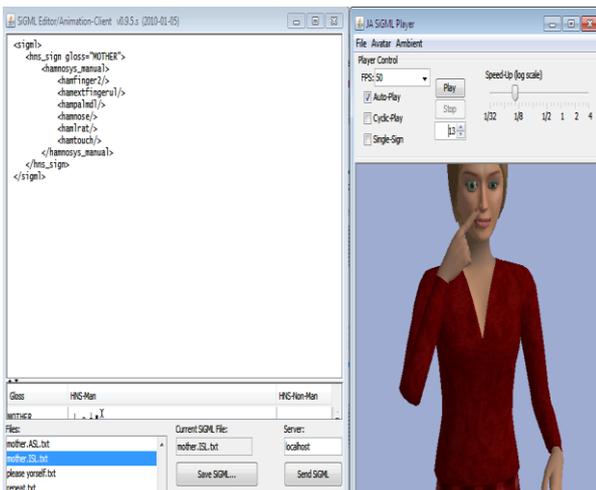


Figure.7. sign for word “Mother”

Figure 8 and 9 shows HamNoSys for word “Mother” and its corresponding SIGML in American Sign Language.



Figure.8. HamNoSys for word “Mother” in ASL

```
<sigml>
  <hns_sign gloss="MOTHER">
    <hamnosys_manual>
      <hamfinger2345/>
      <hamthumboutmod/>
      <hamextfingerul/>
      <hambetween/>
      <hamextfingerur/>
      <hampalm1/>
      <hamchin/>
      <hamclose/>
    </hamnosys_manual>
  </hns_sign>
</sigml>
```

Figure.9. SiGML for word “Mother”

Figure 10 and 11 shows the snapshots of the sign for word “Mother” with the help of tools according to American Sign Language.

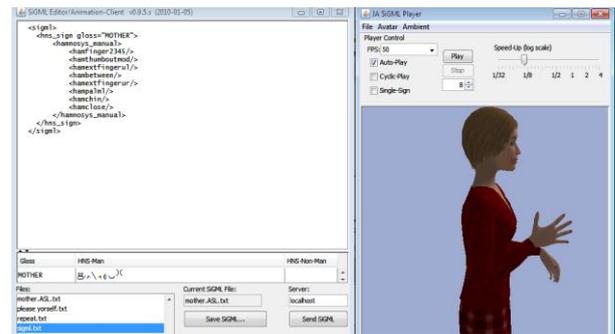


Figure.10. sign for word “Mother”

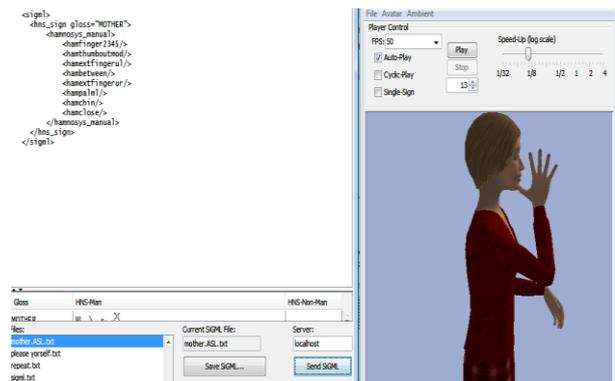


Figure.11. sign for word “Mother”

As we shown above that Sign for word “Mother” is different in India than the sign for word “Mother” used in America. The results of this system prove that sign language is different in every country. These results also prove that sign language is not universal. Table I shows some of the example words generated and used for testing. The efficiency of these notations tested manually and results are very encouraging. Table I. words with their corresponding HamNoSys and used for testing.

Words	Generated HamNoSys	
All	<input type="checkbox"/>	[5]
Abuse	<input type="checkbox"/>	
Bad	<input type="checkbox"/>	[6]
Big	<input type="checkbox"/>	
Bird	<input type="checkbox"/>	[7]
Boy	<input type="checkbox"/>	[8]
Thank You	<input type="checkbox"/>	[9]
Give-me	<input type="checkbox"/>	[10]
Mother	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	[11]

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## 6. CONCLUSION AND FUTURE SCOPE

This paper presents HamNoSys for words according to the signs used in India. This paper shows how HamNoSys and SiGML are important for sign language animation generation system. Research on Indian Sign language is very limited. There is only one system that generates animation corresponding to the Punjabi sentence. HamNoSys notations are developed in this system. These notations have been tested manually by using URL APP and results are compared with standard signs to check its accuracy. Results of this system are very encouraging. This system generates HamNoSys for simple words. Complex words are not included in this system.

In future this research work can be enhanced by generating HamNoSys corresponding to complex words. HamNoSys corresponding to non-manual functions can also be generated in near future.

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