ISL (Indian Sign Language) Dictionary using Synthetic Animations (Extension to Existing)

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Abstract

This paper presents extended vocabulary in ISL dictionary using synthetic animations which uses virtual character instead of a real human. Unlike other spoken languages such as English, Hindi, Bengali, Punjabi Urdu, etc., sign language cannot be written. HamNoSys is an international code system that is used to write any sign language. This HamNoSys code is then translated into SiGML code by using a third-party tool. At last Sigml player generates the synthetic animation. This dictionary can be used by special educators while teaching ISL to deaf students. This synthetic animation dictionary can be used for a conversion system in which written or spoken text can be translated into ISL animations.

Keywords: Communication; Deaf Community; Dictionary, ISL, Sign Language

1. Introduction

Sign Language is a visual gesture or visual-spatial-based language used by hearing impaired and speech impaired people to convey their messages, plans, views, and meanings with normal people**.** It was developed by the efforts of deaf communities which include friends, families, educators, partners, and relatives of hard of hearing community. Sign language is the medium of communication used by hearing impaired and speech impaired people for communication purposes [1]. For such people, sign language is the only mode available for communication so it can be recognized as the mother tongue or first language for hearing impaired and speech impaired people. Sign language was identified as a familiar and an accepted language in the 16th century. In sign language, people used various gestures using their hands, body postures, shoulders, eyelids, eyebrows, head, and face expressions are used to convey what they want to say instead of sounds. In 1620, The Spanish monk named Bonet published his first book that inspires hearing impaired people to learn and read sign language. In France, the first school was opened for hearing impaired people by Abe de I Epee in 1750**.** But before the 16th century, deaf people felt alone in society because they felt it was very difficult to communicate with anyone.

They wanted to talk with normal people but the biggest barrier was language between them which was not understood by each other. Normal people looked at them as "mentally defective" because of a lack of communication, education, and the development of gesture language. During the 16th century, they realized that they could communicate with each other by using their hands but at that period deaf people had trust only in themselves. In groups, families, and relatives where there was more than one individual who is hearing impaired, they started to talk with each other by using their hands, body movements, and arms. After passes so many years this form of communication is now known as sign language. Sign language is not a universal language because it changes from region to region, area to area, nation to nation, and country to country [2]. Each region or country has its sign language and each sign language has its own rule and regulations. For example, American Sign Language and British Sign Language are quite different and mutually unintelligible, even though the hearing people of the United States and the United Kingdom share the same spoken language. Some countries which use a single spoken language throughout may have two or more sign languages, or region that contain more than one spoken language might use only one sign language [3].

There are 63 million people in India who suffer from auditory loss [4]. **Among most deaf people do not know about communication mode** [5]**.** Communication for deaf people in public places such as hotels, malls, bus stand, railway stations, post offices, police station, bank, cafe, market, etc., is a very challenging task because normal people do not know sign language used by the deaf community for communication [6]. Also, normal people cannot communicate with deaf people because they cannot understand normal people's language. To bridge this gap between deaf and normal people, a language translator is a must. To implement language translation of any language, the first and main necessity is a bilingual dictionary. English to ISL, a bilingual dictionary consist of 1000 signs in form of graphical icons was released. Such a dictionary has many lacks such as face expressions and body movements. That's why if a very difficult task to understand signs. So, there is a requirement to build a synthetic animated dictionary that can represent each written/spoken word correspond to an animated sign. Three kinds of animations can be formed:

• Each spoken/ written word is connected with the pre-recorded human video.

• Each spoken/ written word is connected with human pictures representing the sign.

• Each spoken/ written word is connected with synthetic animation (Avatar representing the sign).

Among these three methods, Synthetic animations (computer-generated cartoon) although they aren't natural, are better as compared to human videos in terms of memory consumption, time conversion, standardization, and flexibility. Human videos cannot be modified as per the requirement whereas Synthetic animations can be modified [7]**.**

3. Sign Language Dictionaries

A lot of Sign language dictionaries have been implemented worldwide. Some sign language dictionaries are available in the form of books. But in the era of computerization, this method has become obsolete. In many countries, sign languages are available in the form of real human video. One ISL dictionary was created in 2015, included around 1820 signs in the form of synthetic animations. We have extended the ISL dictionary using synthetic animations.

HandSpeak: is an American Sign Language dictionary created by Jolanta Lapiak in 2000 and released on handspeak.com. This dictionary included human videos that performing signs in ASL correspond to words, abstract words, sentences, inflectional verbs, etc, All signs were signed by those who speak ASL and all videos were recorded very clearly. Today handspeak.com website preserves the authenticity of ASL, heritage, deaf culture, Deaf people, and Coda. The user can easily search the word by typing keyword in the search box, click and signer in human video presents the sign. It is more useful when the learner trying to understand the hand movements of the individual sign. This dictionary is very helpful for all age groups of people to learn ASL [8].

 Basic terms dictionary in ASL: This dictionary consisted of both text definitions and animated signs. The text definitions represented the sign to help to visualize the sign. The user can easily learn the signs by reading how to sign performed and the user can view the animated sign by clicking on the play button. The user can easily view the sign on the full window screen. New words and corresponding definitions can be easily added to this dictionary. More than 1270 words are presented in it. Also consisted of alphabets and numbers sign from 1 to 10 and the rest of the numbers are presented by using combinations of numbers 1 to 10. The main target of this dictionary is to enable people to communicate in ASL easily with each other and help those people who want to learn ASL [9].

Signing Savvy: It is an ASL online dictionary including thousands of sign in the form of human videos with good resolutions, numbers quiz, alphabets, words list and other basic signs used in daily life within the Canada and US. This resource is provided additional information along with each sign video such as when to use sign, how to do, how to remember the signs. All signs are presented by ASL experts. It is a very useful resource for deaf, teachers, parents, and caregivers, etc., to learn signs at home. The main target of this dictionary is to bridge the gap between access to sign language and hearing parents[10].

Spread the sign: is the world's biggest online sign language dictionary included 400,000 words in different sign languages. The learner can easily learn the sign by searching words or sentences in corresponding sign language. All the signs are presented in the form of pre-recorded human

videos. This international project is administrated by the European Language center. Now the team is trying to add more words and improve the quality of signs [11].

SignBank: This dictionary has been launched in 2014 and developed by DCAL (Deafness Cognition and Language) Research Centre in London. It is a free-living BSL dictionary consisting of 2500 signs from the BSL corpus in the form of pre-recorded human videos as output. The dictionary included more signs for UK places names, common words A to Z, colors, numbers, fingerspelling, country signs, etc, as compared to other BSL dictionaries. The user can easily learn signs by using the SignBank dictionary. The sign team target to add more latest proposed words from the hearing impaired community where suitable [12].

Mook Badhir Mandal: is an ISL (Indian Sign Language) dictionary, founded by Shri Amrutbai Parikh in 1972. The dictionary included signs according to categorization such as verb, adverb, noun, adjective, numbers, etc,. Each sign video is presented along with text description. The text description explains about the word that is presented in sign language through human video. The deaf and normal community can learn ISL by using this dictionary. The main motto of this organization is to decrease the communication barrier between deaf and their parents and promote equal rights of each deaf person [13].

ISL Portal: It offers a large number of signs in ISL. Each sign has a human video along with a text description. The organizer members are continually adding new signs in the portal. . It is a very helpful source while we learn ISL. Special educator s can use this portal while teaching the various subject in ISL [14].

ISL Dictionary: The first ISL dictionary launched by ISLTRC (Indian Sign Language Research and Training Centre) in 2018 in New Delhi. The first edition of the ISL dictionary included 3000-word signs in the form of human videos corresponding to English words. The second edition of the dictionary released on 27 February 2019, included 6000 terms in DVD form. The third edition of the ISL dictionary was released on 17 February 2021 with 10.000 words in an online show. The released ISL dictionary includes signs of everyday terms, medical, technical, agriculture, and technical terms, etc., with Hindi and English words. The main objective of developing a Sign language dictionary is that to remove the language/communication barrier between the hearing impaired and the normal community [15].

3. HamNoSYS Code

This HamNoSys code system was developed in 1984 by Siegmund Prillwitz at the University of Hamburg, Germany. It is a phonetic transcription system for gesture languages [16]. HamNoSys was invented by those people who were in a group of normal and hearing-impaired people. It was worked as a scientific and research tool that was made openly. This should be able of every

sign language. It has been worked for 200 symbols which are covering every hand shape gesture as a signing parameter that holds hand shapes, hand orientation, hand movements, and location of the hand. It is possible to note down facial expressions such as eyelids, eyebrow frown up or raises, shoulder movements, etc. Still, there is a requirement to improve the HamNoSys tool. In the standard text processing system and the applications of the database, the HamNoSys tool can be a boon to use. The syntax format is well defined in this system so that, the standard computer tools can be integrated with this system with ease [17].

4. Result Evaluation and Discussion

We created a bilingual dictionary English to ISL by using Figure 1 architecture. Unlike other spoken languages such as English, Hindi, French, etc., sign language cannot be written. HamNoSys is a code system that is used to write any sign language. This notation system can express manual and non-manual expressions of signs
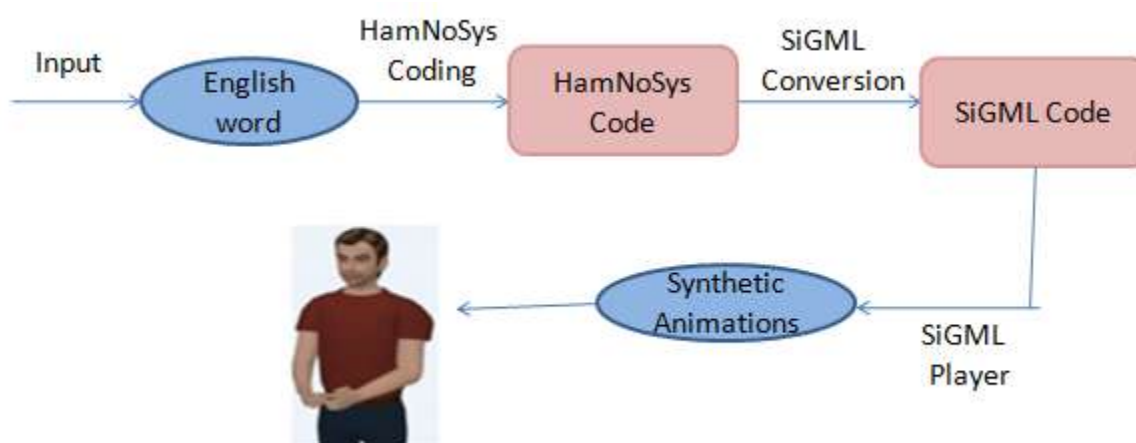

Figure 1: Architecture to generate synthetic animations from English words.

A third-party software named e-Sign editor has been used for the conversion HamNoSys code to SiGML code. Then SiGML player produces the synthetic animation of signs by using SiGML code. Currently, we have a collection of commonly used 3000 vocabularies are taken for dictionary. These words are most commonly used by hearing-impaired communities in their daily life. These words are under categorized as adjectives, adverbs, interrogatives, Numbers, nouns, pronouns, prepositions, verbs, Table 1.

Category of Word	Total No. of Words	No. of Words Implemented
Adjectives	375	305

Adverb	50	50
Determiner	10	8
Interrogatives	20	17
Number	25	25
Noun	1873	1559
Pronouns	32	28
Prepositions	35	35
Verbs	579	473

Table 1 Number of words implemented

Among these words 2700 words has been coded in HamNoSys code along with non-manual expressions. Collection of composited signs has been coded in HamNoSys code. For example, the composite word "brother" is made up by combination of two signs for man and sibling (brother = man+sibling). Some words Names of places, persons, unknown words are represented by finger-spelling. Some signs screenshots are displayed in Figure 2 to Figure 3. These signs have been compared with interpreter videos and ISLRTC   dictionary videos for accuracy purpose. These signs have been checked by students of deaf school s and ISL interpreters. The signs shown to them were clearly understood and all appreciated this work.
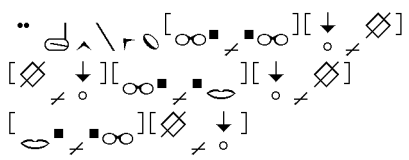
Word : Cry		
HamNoSys Manual Code	Lipsing SiGML Code	Snapshot of animation
⠂⠂ ⌐ʌ\ᵣ◊[∞▪↙▪∞][↓。↙ ⊘] [⊘↙↓。][∞▪↙▪◠][↓。↙ ⊘] [◠▪↙▪∞][⊘↙↓。]	<hnm_mouthgesture tag="L29"/>	

Figure 2: Snapshot HamNoSys Code, Lipsing SiGML code of word cry

Word : Kill

HamNoSys Manual Code	Lipsing SiGML Code	Snapshot of animation
·· [◯ ┌ \ ‹ ◔ ⌐ ◯ ◮ 0] [▽ \ ▪ ◯ ⌐ ▽ \ ▽] [[↘ * ↣ ◮ \ ┌ ◌ \ ◌ ↘ *] ⌐ ⌀]	`<hnm_mouthpicture picture="kI:"/>`	

Figure 3: Snapshot of HamNoSys Code and Lipsing SiGML code of word cry

5. Conclusion

This paper presents the method for extending the synthetic animation ISL dictionary. Synthetic animations are not looked natural as compared to human videos. But Synthetic animations are good in terms of storage rate and time frame for execution. Synthetic animation take short time for execution and less memory area for storage as compared to human videos. This work is very useful for conversion English to ISL.

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