

# Framework for Bengali Text into Sign Language with Pedagogical Agents

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**Abstract:** Sign language is a mode of communication among the deaf and dumb. The sign language is not same for all the general expressions that are used all over the world; it is identical like as mother tongue. Pedagogical agents are life-like animated characters which offer great promises for learning environment. This paper discusses about the conversion of Bengali-text-to-Sign and Bengali-text-to-pedagogical agents' expressions. Previously, there were lots of applications to translate speech-to-text, text-to-speech, text-to-sign and pedagogical agents in tutorial system, game making etc. This web application which is based on JavaScript and php(Hypertext pre-processor language), focuses on building a learning system that helps to teach physically challenged people in West Bengal, India. According to 2011 census, 50% deaf and dumb people all across India are illiterate. This application works to convert text-to-sign and text-to-pedagogical agents expression simultaneously.

**Keywords:** sign language, pedagogical agents, multimedia, Web technology

## I. INTRODUCTION

Deaf and dumb people communicate with each other using sign language. Sign language express with not only the symbol of sign but also movement of body. Charles-Michel de [2] had developed the first sign language in French at around 18 mid-century for deaf people of France. In January 1999, the Ramakrishna Mission had embarked upon a very unique project in collaboration with CBM International, Germany - to standardize Indian Sign language(ISL). The project completed in November,2001 and the first Indian sign language dictionary was released. The ISL dictionary was an earnest attempt based on years of research with documenting over 2500 sigs from 42 cities in 12 states to provide a common sign language code all over India.[28]

The life-like animated pedagogical agents are animated characters that facilitate learning in computer-based learning environments. These agents have animated personas that respond to user actions and in additionally, they have enough understanding of the learning context and

subject matter that they are able to perform useful roles in learning scenarios.

In this context, system generates a web application with help of JavaScript and php(Hypertext pre-processor Language) codes which display sign images as per inserted word with proper grammatical approach. There are lots of logical functions or method in this application which split text into words, identify words with syntactic analysis and semantic analysis. After that arrange them and retrieve sing image from sign data dictionary, there is a pedagogical agents which instruct people step by step and show different expression as type of sentence(assertive, negative, interrogative, Imperative and exclamatory). Several studies have reported that an animated agent leads to better interaction between the agent and learner

This paper is followed by five identical parts. First part discuss about aim of the thesis. Second part is mention about Bengali sentence syntax formation and character setup. Third one is the conceptual part where we discuss about characteristic of sign language. Fourth part is the animated character setup part where we mention about pedagogical agents. Fifth is mentioned about the objective and design of the system and lastly the conclusion and future scope where we should modify our system in future.

## II BENGALI SENTENCE FORMATION

In every language there is a general syntax formation of sentence. It is a grammatical approach to form a sentence properly and meaningfully. In this paper, user given input is syntactically correct or not checked by system. Like English language, Bengali has its own syntax formation which is quite different from the English language. Let take an example, in English "I go home" where the sentence form with "Subject +verb +object", if we translate this sentence in Bengali word by word then we get "আমি যাব বাড়ি" but this is not a correct Bengali syntax of a sentence. In Bengali object comes before the verb so the right syntax is "Subject + object+ verb" then the correct translation of the English sentence is "আমি বাড়ি যাব ". So it is very important to know whether the user or the candidate provide a input which is syntactically correct or not then to overcome this

problem system should checked the given input through linguistic analysis.

**Syntactic analysis** is process of analysis in a string of symbol, either in natural language or in computer languages, conforming to the rule of formal grammar. Within computational linguistics the term is used to refer to the formal analysis by a computer of a sentence or other string of words into its constituents, resulting in a tree showing their syntactic relation to each other, which may also contain semantic and other information.[1]

In linguistics, **semantic analysis** is the process of relative syntactic structures, from the levels of phrases clauses, sentences and paragraphs to the level of the writing as a whole, to their language-independent meanings. It also involves removing features specific to particular linguistic and cultural contexts, to the extent that such a project is possible. The elements of idiom and figurative speech, being cultural, are often also converted into relatively invariant meanings in semantic analysis.

Bengali language is not platform independent which mean we cannot generally execute Bengali words in all platforms. Now a day, many web browsers support the Bengali languages but there are some problems to fetch and retrieve data both in database and web browsers. We overcome that problem with the help of Unicode setup. Unicode provides a unique character for every character, no matter what the platform, no matter what the program, no matter the language. The Unicode Standard has been adopted by such industry leaders as Apple, HP, IBM, Just Systems, Microsoft, Oracle, SAP, Sun, Sybase, Unisys and many others. Unicode is required by modern standards such as XML, Java, ECMAScript (JavaScript), LDAP, CORBA 3.0, WML, etc., and is the official way to implement ISO/IEC 10646. It is supported in many operating systems, all modern browsers, and many other products. Unicode can be implemented by different character encoding. The most commonly used encoding are UTF-8, UTF-16 and the new obsolete UCS-2. UTF-8 uses one byte for any ASCII character, all of which have the same code values in both UTF-8 & ASCII encoding & up to four byte for other character. We work with UTF-8 Unicode version in our development side below we show some example of Bengali Unicode [22].

### III. SIGN LANGUAGE

Sign language is a virtual language which can express with manual, facial and body movement. It is a communication process among those people who are suffering from hearing problem. A gesture in sign language is the counterpart of the word in an oral language[BaSL]. We have mentioned earlier that it is not a universal language. Sign language is structured like spoken language. Sign language also has its own morphological, grammatical and lexical levels. There are differences at each and every level in different sign language. So, Bengali sign language also has a difference in other sign languages. Generally we are following India-

Pakistan sign language but there are so many other languages followed in different part of our country[18]. In this paper we mention about Bengali sign language below we show some images which will used in our data dictionary.

Previously we have mentioned that signs are executed with video file or AVATAR . In here ,system work on the images which not only show the symbol but also show the action of the symbol because we know that in sign language two thing work with parallel one is symbol another its' action. There is an problem in video file, videos only retrieve from database if the user input and the database data will be matched but some time user given input does not match with admin's database data so in that cases user does not get his/her expecting results from the system. So, we work with the image file to overcome this problem in our system we check whether the user given data is syntactically or semantically correct or not if anything require to change system informed the user if not then the expected result will be executed to the user.

### IV. PEDAGOGICAL AGENTS

A pedagogical agents creates an environment that mimics the human like classroom social interaction[12]that is typically missing from electronic learning environments [11] "Using an animated pedagogical agent with verbal and non-verbal features fosters information processing because students naturally perceive the learning process as social and response more engagingly"[7]. In additional to creating a positive learning system, pedagogical agents allow teachers to provide individualized instruction to learning that's tailored to the learners' learning abilities, rate of learning and needs.

### V. OBJECTIVE AND DESIGN

Our aim to develop parallel conversions of Bengali text to sign language and text to pedagogical agents. For that purpose, we face lots of challenges. Generally web browser and Database work on universal language but our process goes to local language so it has a problem to insert and retrieve data in both side. Another problem is that how to execute the sign of the sign language because sign languages is not only the sign it also the movement of hands, some sign express with single hand and some have double handed. Pedagogical agents is totally an animated character and human express several emotional expression according to events, so it is difficult to merge animated character with emotional expression in word formation. In this paper we propose our own logical approach to develop that thing around overcome those problems and user or candidate can easily understand the conversion.

Our main objectives to design and develop framework for Bengali text to sign language with pedagogical agents.

1. To understand Bengali both in browser and database because generally database work with programming language which is written by

English, do not understand the Bengali alphabets or word. So, it is difficult to insert and fetch data from the database and also executed them in the web browser.

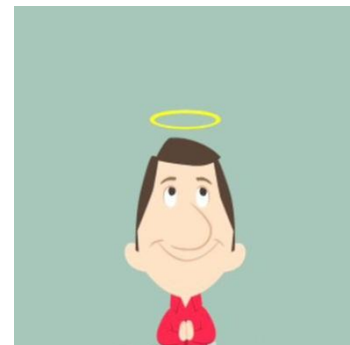
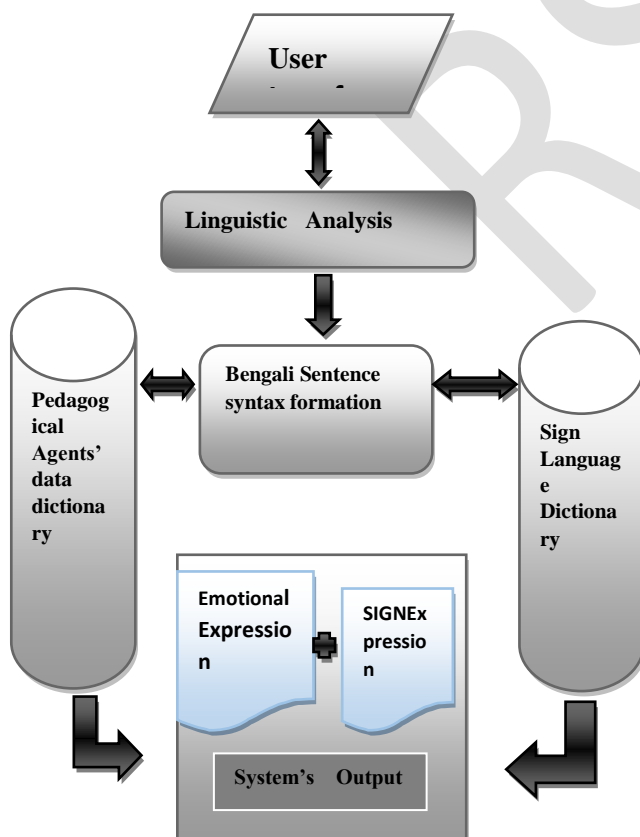
2. To generate automatic translation of a written text to sign language should not to be word to word translation. As all natural language processing applications, it requires a lots of information likes grammatical, translation equivalence etc. The most difficult aspect remains the semantic analysis.
3. Sign language is not universal. Like natural languages, sign language is varying from region to region. Hundreds of sign language exists in the world and are at the core of local deaf and dumb culture. [wiki]
4. To construct of sign data dictionary is an expensive and needs lots of time.
5. To generate pedagogical agents which is a lifelike animated character totally design by animated software and it is needs time to create that type to characters.
6. To classification of emotional expression, there are seven general emotional expressions like: Anger, Contempt, Fear, Happiness, Sadness and surprise. This emotion executes with different words or same word with different expression has different meaning so it is difficult to classify emotional character as per identical word.

The **syntactic analysis** allows spotting to links between words which is based on a grammar of the language. This analysis checks whether the given input is syntactically correct or not.

**Sematic analysis** is followed after by the syntactic analysis. Sematic analysis generally identify the meaning of the sentence or meaning in between the words presentence of the sentence. It is a very complex procedure, in here we have focused on the doing verb which is identify in syntactic analysis. The sentence is affirmative or negative identify it with base on verb, so we can identify the verb then we also identify the sentence. After that we have classification sentence in assertive, interrogative and optative/exclamatory. Apart from that we have divided the sentence in two form, one is subject another is predicate.

After complete the linguistic part then parallel process goes on, one of the processes is Bengali text to sign language conversion. In here we have mention that the conversion of text and arrangement of sign images to express.

Previously we have mentioned that a pedagogical agent is an animated lifelike character. It is parallel process with conversion of text-to-sign languages, in one hand where the sign language is generated then the other side also the pedagogical agents' express emotional expression. Human have several expression but it is very time consuming to develop all expression as per in animated character. So, we are selected basic seven expressions which are generally express by human's action. Below we show emotional expression which are helped us to develop our own pedagogical agents



To generate pedagogical agents' expression as per user interface, we create a keyword analysis module which identify the keyword from the text and execute animated file as per meaning of sentence. Human character generally used different or same word with different expression to execute emotion like happy, joy, anger, sad etc. We create database those kind of keywords with unique ID (integer data type) and insert animated file as per those ID when the insert text's word match with keyword then the animated file retrieve from database and show in browser. Here I mention some classify keywords which carry different pedagogical agents' emotional expression.

Keywords	Pedagogical Agents' expression	Sentence/ Example
কে, কোনটা, কি, কখন, কোথায়, কখন, কেন	Question/ Interrogative	আমি কে? (Who am I?)/ কোনটি নতুন? (Which is new?)
কি সুন্দর/ কি বিশাল/ কি বোকা/ কি বিগ্নী	Happy/ joy/ sad/ exclamatory	কি সুন্দর দৃশ্য! (How beautiful the scene!)
হায়/ বিদায়/ ধিক/	Sad/ Exclamatory	বিদায় বন্ধু / হায়! কি হল আমার/
বলবে/ করবে/ কর/ থাকবে/ হারিওনা/ দাও	Advice	সদা সত্যি কথা বলবে/ জাতির সেবা কর/
বসুন/ করুন/ অপেক্ষা কর/ করনা/ দিওনা	Request	একমিনিট অপেক্ষা কর/এখানে বসুন
পালন কর/ আসতে দাও/ শুনবে না	Ordered	গাড়িটা আসতে চালাও
যাবই/ ডুবেই/ জেতাই হবে/ করতেই হবে	Emphatic	আমাকে জেতাই হবে
থাব/ যাব/ দেখব/ খেলব	Normal	
বাড়ি যাব/ ঘরতে যাব/ খেলতে যাব	Happy/Joy	আমি বাড়ি যাব আমি খেলতে যাব
স্কুলে যাব/ পড়তে যাব/ অসুস্থ/ দরিদ্র/	Sad	আমি স্কুলে যাব

দোষী/ হারিয়া গেল/ চলেগেল/		
জিতেছি/ পেরেছি/ করেছি/ ধরেছি	Achievement	পুলিশ চোর ধরেছে

## VI. CONCLUSION AND FUTURE SCOPE

In this paper, we have reported to develop a translator for converting the Bengali text to sign language and corresponding text to pedagogical agents' expression. We represent a linguistic analysis formation of sentence (if necessary) and get proper meaning of sentence for pedagogical agents'. This web application help students to learn sign language. The sign data dictionary develop with identical words, so students can learn identical terms of sign language or sentence in here. This application totally images file base application where each and every identical image not only show the sign but also express the movement, so it is easily understandable and memorable[ ]. Student can easily understand how much their inputs are correct or not and also learning emotional expression with the help of pedagogical agents. We basically work with seven general emotional expressions that cover large area of emotion. We already describe our approach and its main different steps and started the implementation of our system, so we looking forward presenting our result in the near future.

In literature, single word uses in many purpose and expression of a particular word have different meaning at particular moment .In this paper we work on basic general term and sentences , so base on this architecture we work on complex sentences and more about emotional expression in future. We have developed this system but there are lots of work will done near future to make this system more attractive and user friendly.

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