Virtual Laboratory – A Learning Enhancement Experience through NLP Application Design

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ABSTRACT
One challenge for teaching fraternity in current pandemic situation is to provide online virtual laboratory experimental education for various Information Technology and computer science courses, along with online lectures to students with a view that they feel like they are sitting in the physical laboratory and understanding and performing experiments, though it is virtual. This paper shares our experience of using Natural language Processing (NLP) virtual Lab for learning morphology, in which we have used various multimedia software which are open source.

Keywords: virtual, laboratory, NLP, Morphology, open source

1. INTRODUCTION
A virtual laboratory is a computer-based activity where students interact with the simulator. It can have no physical reality behind it at all. Morphology is a branch of linguistics to convey how words are formed from morphemes. The dictionary meaning of morphology is - the form of words, studied as a branch of linguistics.

This paper aims to provide the complete design of Morphology – one of the NLP applications and provides the idea to students about what morphology is and how it is applicable to different languages. They can practice it with different root words given in the dropdown menu and apply their morphological ideas to the table. Upon getting the correct selection of ‘matra’, they can get the correct answer. Else, individual wrong mark in red will be displayed against that row of the table.
2. LITERATURE REVIEW

Virtual laboratory is also referred as Computer Based Simulation, Virtual Learning System, Virtual Lab System or just Simulations. Under the National Mission on Education through ICT the Ministry of Human Resource Development has initiated the Virtual Labs project. These labs will now be used by the students all over the country. In this paper, we are describing the steps for NLP Morphology Virtual laboratory by taking reference of existing virtual labs.

The traditional laboratories are easy to use and may sometimes be less expensive, but the virtual laboratories provide many advantages than the traditional labs. The virtual labs if properly designed taking into consideration the online multimedia instructional design principles can enhance the skills in the students. Due to the availability of virtual laboratories at anytime and anywhere, can give the students an opportunity to explore the experiments and reflect on the results obtained.

NLP is a field of Computational linguistics and is associated with human to convert information from computer to natural language using NLG (Natural Language Generator) and to convert reverse way using NLU (Natural Language Understanding). There are many Indian languages but mostly we consider Hindi language as an Indian language, when we compare it with English.

3. IMPLEMENTATION OF NLP MORPHOLOGY APPLICATION:

The virtual laboratory is designed using html, CSS and Java script, which are open source. This virtual laboratory is made user friendly, in which students can interact while operating the simulator of morphology. We have included total eight steps in this virtual laboratory, namely Broad Goal, Learning Objectives, Theory, Pre-Test, Procedure, Simulator, Post Test and References.

**Broad Goal:** The Broad Goal of the experiment is to understand the morphology of a word by the use of Add-Delete table.

**Learning Objectives:** Students will be able to select the root word, delete the tense from the word to find the stem of the word, add the appropriate tense to make it the correct word asked as either singular or plural with direct (nominative like - he, they) case or singular or plural with oblique (like him, them) case, check whether the selected tense is correct as per the asked in the question, get the correct answer if couldn't complete it correctly.

**Theory of Morphology:** Morphemes are considered as smallest meaningful units of language. These morphemes can either be a root word(play) or affix(-ed). Combination of these morphemes is called morphological process. So, word "played" is made out of 2 morphemes "play" and ",-ed". Thus, finding all parts of a word(morphemes) and thus describing properties of a word is called.
"Morphological Analysis". For example, "played" has information verb "play" and "past tense", so given word is past tense form of verb "play". Another example of Morphology is Motivation having various forms - motiv, motivate, motivation.

**Procedure:** There are only three steps to be followed by the user to operate the simulator. Usershould select a word root, Fill the add-delete table and submit.

If students submit the correct pre or post word as asked in the question to convert the root word into singular or plural, past or present tense like un, s, es, ed, ing etc then the right mark in green displays and upon selecting the wrong pre or post word, a wrong mark appears in red color. If the answer is incorrect, then student has to again start from the step 1.

Figure 1(a): Overall design of virtual lab along with simulator with incorrect selection

Figure 1(b): Overall design of virtual lab along with simulator with correct selection
**Simulator**: It is the main task of designing the virtual lab. The Simulator diagram is shown below as per our design. Figure 1(a) shows the Overall design of virtual lab along with simulator, with incorrection selection done by students while learning morphology whereas figure 1(b) shows the Overall design of virtual lab along with simulator, with correction selection done by students while learning morphology. If a student is clueless about what to select then he/she can click on the Get Answer button to get the correct answer and after studying it, he/she can apply his/her own answer again to simulator.

As per the step 1, user or student has to select the root word. Then select the delete and add ‘Matra’ as per the asked in the question. Sing stands for singular, plu stands for plural. Ob stands for oblique case and dr stands for direct case. After selection done, user requires to click on submit button.

Upon selecting the correct answers, It shows all right marks in green in the table and displays the message ‘correct answer!’ in green.

There are pre-test and post-test designed to check whether student has understood it correctly or not. Students can appear any number of times to that test, basically because it is for improving their understanding and not for doing any kind of the evaluation. The pretest and post test are displayed in the figure 2(a) and 2(b) below:

![NLP Morphology Virtual lab](image)

**Figure 2(a): Pretest**

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Answer the following questions after reading the Theory

**Question 1.**

---------- should be deleted from the root word तृणका and ---------- should be added to it to change it to singular and direct case.

- ओि and ओि
- ओि and ओि
- ओि and ओि
- ओि and ओि

**Question 2.**

---------- should be deleted from the root word तृणका and ---------- should be added to it to change it to singular and oblique case.

- ओि and ओि
- ओि and ओि
- ओि and ओि
- ओि and ओि

Number of score out of 2 = 1 Score in percentage = 50%
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4. FUTURE SCOPE:

This paper uses limited words for only one language. So, further enhancement can be done for all words of the language. But it seems difficult to do so. Other enhancement can be done that other Indian languages can also be added. For that one more dropdown menu can be kept in the beginning of the simulator about selection of languages. As per the language selected, some more words can be added for that language to study morphology. Further, in this paper we have worked mainly for noun but in future, more work can be carried out on verb and adjective also.

5. REFERENCES:


