iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 **Issue:** VIII **Month of publication:** August 2021

DOI: https://doi.org/10.22214/ijraset.2021.37473

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue VIII Aug 2021- Available at www.ijraset.com

Computerized Answer Grading

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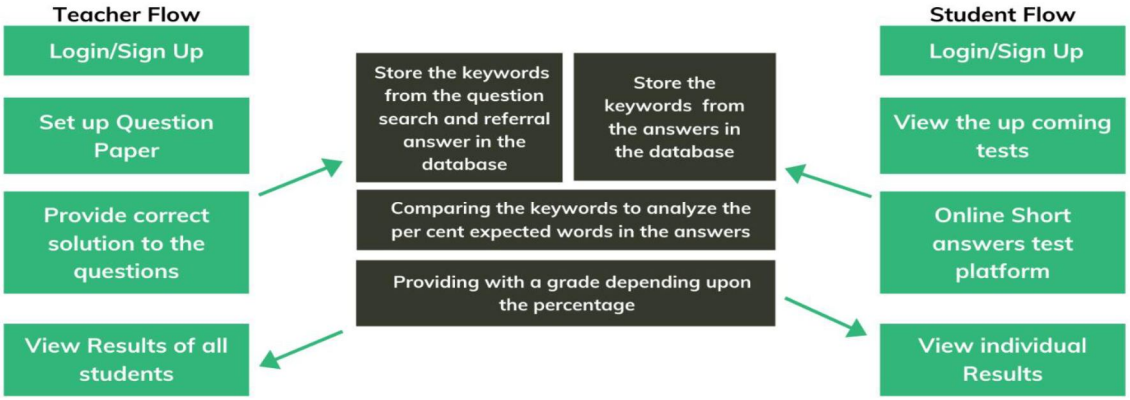
Abstract: ***Looking at the current scenario of teaching and schooling, everything is shifting into online mood. Close are the days where not just the MCQ's and one-word answers will be auto-graded but the entire paper will be feed into a system and graded automatically lessening the burden of the teachers. The purpose of this project is used to evasion the grading system for the person who is grading the candidate as well as the candidate who us taking the test. This system will help the candidate to give expressive and well explained answers on the other hand if the person asking the question is not satisfied by the explanation, they can ask the candidate to explain a bit more or structure the answer better. The grading of the answer will automatically happen by the system hence reducing the burden of going through the entire answer. Our greater objective is to create a system which automatically grades a paper consisting of all types of questions and answers, be it long essays, short answers or one word answers.***

Keywords: Autograding, NLP, Doc2Vec, Word2Vec, Short Answers, Machine Learning, grading.

I. INTRODUCTION

Innovation in education has come a long way in improving the efficiency of grading. Short answers are open-ended questions. Unlike multiple-choice questions which have a given set of answers, short answers can have a range from a single word to a few sentences. Multiple choice questions can be easily scored while short answers are scored by a human grader because of their nature. Therefore, scoring short answers is time-consuming and can also lead to human errors. Auto-grading systems are increasingly being deployed to meet the challenge of teaching programming at scale. We propose a methodology for extending autograders to provide meaningful feedback for incorrect programs. Our methodology starts with the instructor identifying the concepts and skills important to each programming assignment, designing the assignment, and designing a comprehensive test suite. Tests are then applied to code submissions to learn classes of common errors and produce classifiers to automatically categorize errors in future submissions. The instructor maps the errors to concepts and skills and writes hints to help students find their misconceptions and mistakes. We have applied the methodology to two assignments from our Introduction to Computer Science course. We used submissions from one semester of the class to build classifiers and write hints for observed common errors. We manually validated the automatic error categorization and potential usefulness of the hints using submissions from a second semester. We found that the hints given for erroneous submissions should be helpful for 96% or more of the cases. Based on these promising results, we have deployed our hints and are currently collecting submissions and feedback from students and instructors. Our object is to come up with a platform to automated the entire process with the help of natural language processing and text matching algorithms. This will help in the growth of machine learning and reduce the burden if teachers



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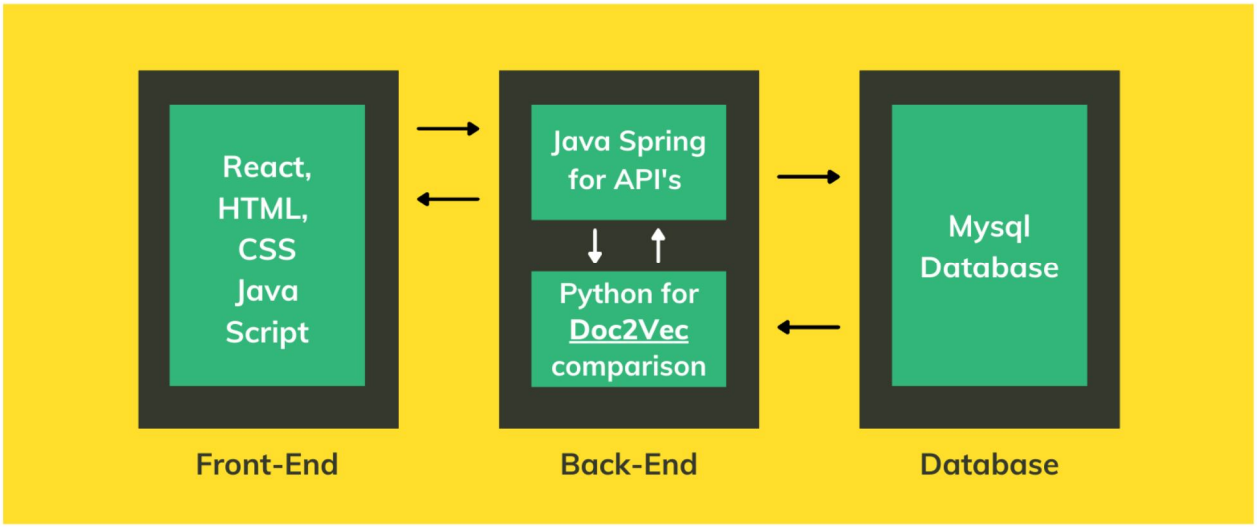


II. BACKGROUND AND RESEARCH

A. Background

Various techniques have been used to score answers.

Mohler and Mihalcea [1] compared various corpus-based text similarity measures and evaluated the impact of size on corpus-based metrics.

Gomma and Fahmy [2] proposed an unsupervised bag-of-words method. They tested different string-based and corpus-based similarity measures and then combined them to improve performance.

Alotaibi and Mirza [3] proposed an integrated information extraction (IE), decision tree learning (DTL), machine learning (ML) method. Their IE technology uses parser and dictionaries, while their ML technology uses classification rules extracted from DTL to automatically mark-free text.

Pulman and Sukkarieh [4] explored computational linguistic techniques for automatically marking short free-text responses. Initially, they solved the problem using IE. However, because artificially designed IE requires skills and expertise in domains and tools, they use several ML techniques (such as DTL and Bayesian learning) to learn IE models.

B. Research

The different tech stacks used by similar Sign Language recognitions systems are Python, Word2vec, Gensim, Numpy and various machine learning algorithms.

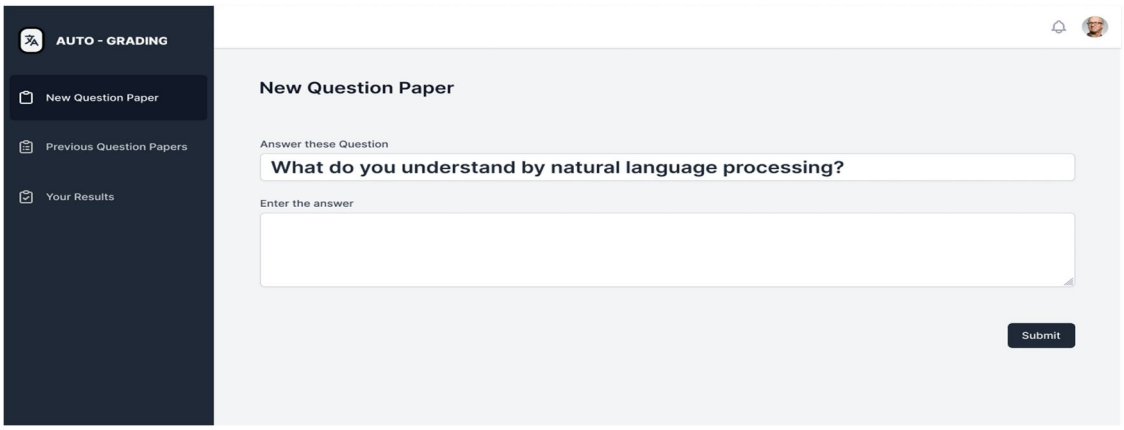
III. IMPLEMENTATION DETAILS

The implementation of the project has two main parts frontend and backend. Frontend is built using ReactJS and Bootstrap, backend is built using Spring-Boot and React axios is used to connect both the ends while data is stored and managed in MySqlDB.

A. The User Interface

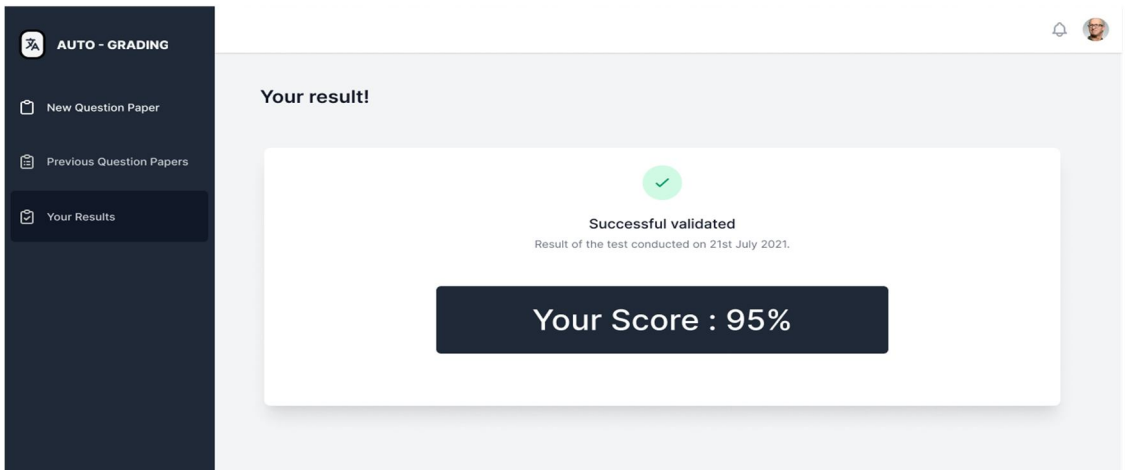
The user interface includes three main components namely , the Teacher's component, the Students component and the Results component.

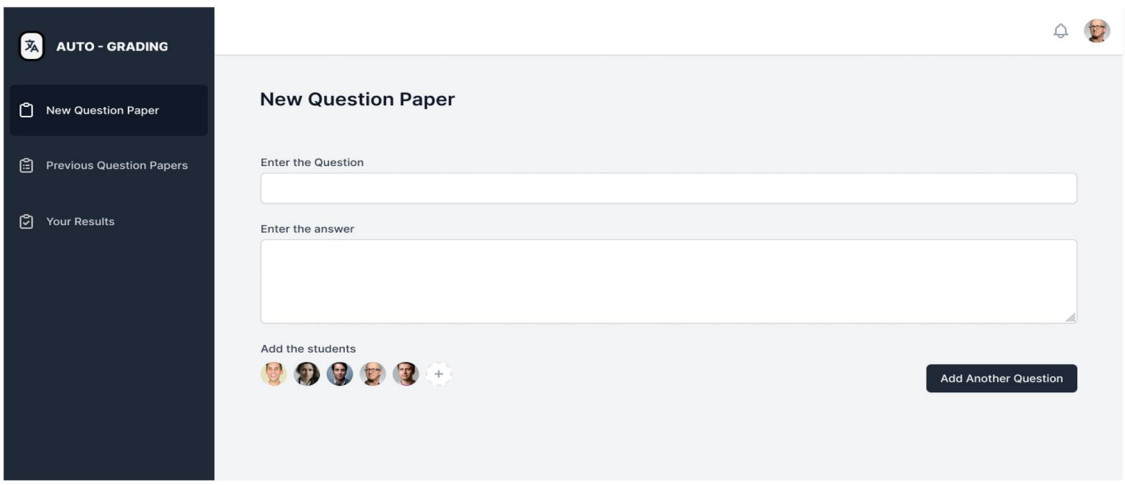
1) *Student Module:* Used by students to check the question paper uploaded by the teacher. The students can view the results of the previously answered tests as well. After writing the test the results are updated here itself.
2) *Teacher Module:* Teachers can set up a new question paper and post it for the students. Teacher can also view the results of all the students who takes the test. Teachers can also access the previous tests held and the scores of the students in it.
3) *Results Module:* The results of the students are shared through this component.



B. Technologies Used

1) *Frontend:* ReactJS framework is used to build reusable component-based UI. It is an open source, declarative code which is predictable and easy to debug. The react hooks help in DOM manipulation. A react application can have multiple or nested components each responsible for rendering a small reusable piece of HTML.
2) *Algorithm:* Doc2vec is an extension for word2vec. The objective of doc2vec is to create the numerical representation of sentence/paragraphs/documents unlike word2vec that computes a feature vector for every word in the corpus, Doc2Vec computes a feature vector for every document in the corpus. The vectors generated by doc2vec can be used for tasks like finding similarity between sentences/paragraphs/documents.





IV. CONCLUSIONS

The system that we have built uses NLP and ML based techniques to evaluate student answers. Our system includes the following steps (1) pre-process the text for further analysis; (2) find various similarity measures; And (3) Score the student answers. In most cases, we find that our proposed method scores tag similarly to manually assigned tags. In rare cases, the automatically assigned mark is slightly higher or lower than the manually assigned mark.

V. ACKNOWLEDGMENT

The authors express gratitude towards the assistance provided by our mentors and faculty members who guided us throughout the research and helped us in achieving desired results. We offer our sincere thanks as it would not have been possible without the guidance, assistance and suggestions of many individuals.

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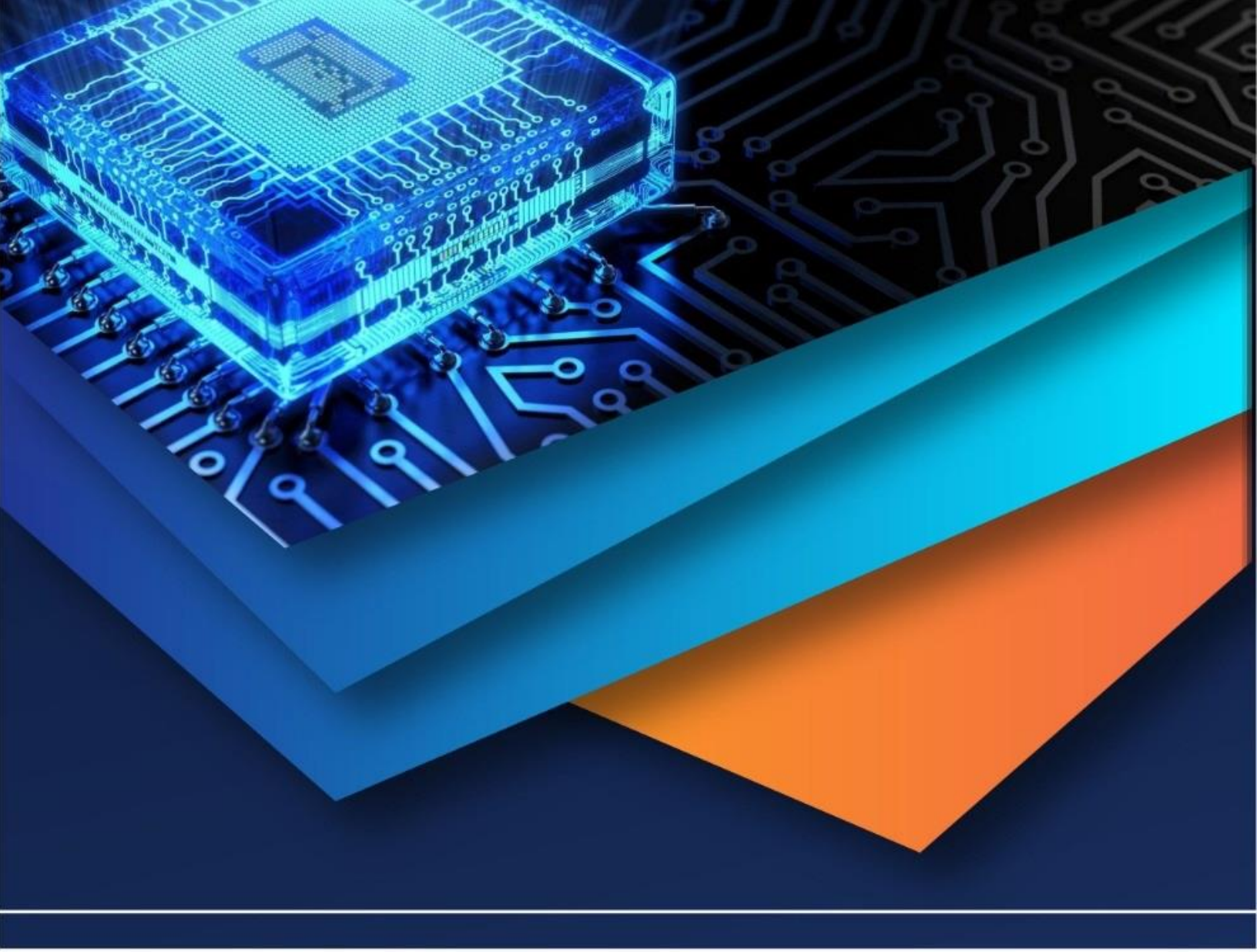

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