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Grade Automation System using Cosine Similarity

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Abstract: ***In the educational sector, new ideas have aimed to increase the efficiency and speed of grading. As a result of these changes, automatic grading techniques have been established to solve some of the problems of grading specialized courses. With the rapid advancement of technology, it's no surprise that automatic grading systems for problems other than typical multiple-choice questions have been designed. According to research, automatic grading techniques are extremely advantageous to teachers because it would take them much too long to evaluate complex assignments without them.***
These automated grading techniques are really not meant to take the place of human grading; rather , they're designed to assist teachers in efficiently grading and analyzing information.
Automation is slowly becoming a part of the educational process, and now we're heading in the right direction. Automating the grading process also helps in avoiding the human error generated while manually checking the answer sheets and provides a sense of uniformity in answer sheet checking and hence is more fair.
Keywords: Cosine similarity, natural language processing, Descriptive type questions, automation assessment, online evaluation, machine learning.

I. INTRODUCTION

Innovation in education has come a long way in improving the speed and efficiency of grading. Homework and exams are high-quality habits to determine undergraduate understanding. Grading of tests for instructors has consequently provided a better means for professors to check on students' knowledge of particular concepts. However, prioritizing tasks is opportunity absorbing and prone to wrongs particularly accompanying a lot of graduates in the Massive Open Online Courses (MOOS) and complex register assignments. This raises the need for a more agreeing and effective ranking method. This challenge has brought about the incident of electronic grading finishes. This paper determines corresponding and judgment of various finishes Second hand for automated ranking for prioritize appointments putting on the influence of these finishes in the learning process. The attempt to apply standardized measurements of varying levels of accomplishment in a course is known as grading in education. Whereas grading is allocating grades, assessment requires assessing those grades. The teacher will need some data to evaluate a student's performance. This data is presented in the form of grades. As a result, assessment is a step beyond grades. Assessment is useful for teachers to give them an insight into the student's progress. Teachers now have additional options for presenting content to students, augmenting instruction, and monitoring student level of understanding, due to the integration of computer-based technologies in the classroom. These systems' ability to provide students with feedback on their work, as well as evaluate student performance and progress to their teachers, would be one of their most significant advantages. While computer-based systems can automatically evaluate student responses to a variety of question types, many systems have limitations when it comes to open-ended questions. Many systems are either unable to support open-ended issues, needing manual grading by the teacher, or avoid such question types entirely. One of the purposes of computer-based learning platforms, on the other hand, is to assist teachers in delivering content to students in order to augment instruction, provide student assistance, and report student learning progress and assessment to the teacher. These systems frequently collect huge volumes of fine-grained student data in order to assist teachers in making more data-driven decisions in the classroom (e. g. helping to identify which homework problems on which to focus a class discussion). In many cases, this is accomplished via the system's ability to grade student content automatically and then transmit that information to the teachers. Students in high school submit assignments that must be graded accurately. Automated grading with a paper grader is a cutting-edge option for speeding up the process of grading large numbers of assignments. Each assignment is frequently double-checked by two teachers to ensure that the grading procedure is devoid of prejudice. To determine the difference, their grades are compared. To ensure correct grading, the assignment is given an average of the grades given by many teachers. This manual method is ideal for ensuring a clear assignment grading process. However, this procedure is excessively time-consuming, and each paper must be graded by more than one teacher. To ensure that the quality of grading assignments is not compromised at any cost, software experts have devised an innovative solution in the form of an automatic paper evaluator.
The automated grading method not only saves time, but also ensures accurate solutions. The AI grading of papers allows for bulk grading of assignments in a short period of time. Additionally, the results are always accurate for each individual.

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A. *Problem Statement*

Our objective is to develop an online paper evaluation system that uses natural language processing to evaluate the answer sheets and automatically publish mark sheets. Using string-based similarity and meaning of phrases, whether or not they include similar words, the scanned answer sheet (by students) is transformed and compared with the answer key (by teachers).

Online answer sheet evaluation can help to ease the process of checking answer sheets for both online and offline tests by adopting this system. There is no physical touch with people, and the overall result processing is not delayed. It is more ecologically sound as well as cost-effective since it uses less paper, printing, and transportation.

II. PROPOSED SYSTEM

The user has to login into his/her account using the Teacher or the Student Login. There are two different authentications for the teacher and the student, where, the Teacher has to login using the Teacher login and the student has to login using Student login only. New users have to sign up by filling up the required credentials.

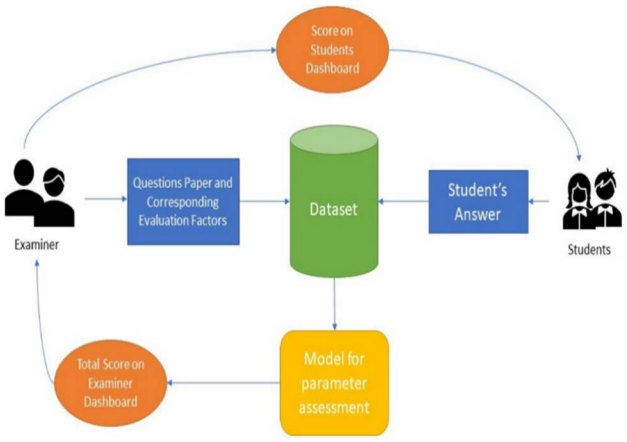
The teachers can create a new test using the SET TEST button in the teacher panel. They can download the answer sheets submitted by the students and display the results in both teacher as well as student panel.

Students can download the question paper from the student panel and have to upload the scanned answer sheets using the Upload button using the same. The submitted answer sheet should be in the .docx or .pdf format only.

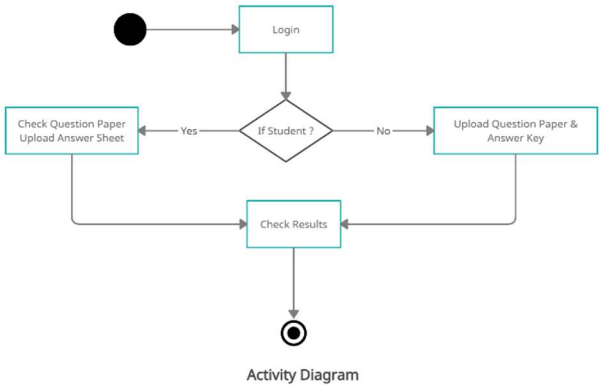
The answer sheet is matched with the answer key provided by the faculty using cosine similarity and hence a final score is calculated in the form of percentage. The results are then viewed in the student panel itself.

In the FAQ section, we answer frequently asked questions from our users. Users can contact us with any other queries by sending an email to the given address.

A. *Architecture Diagram*



B. *Activity Diagram*



Activity Diagram

Different technologies are used for creating web applications. The process of web development consists of two parts i.e.
1. Front-end
2. Back-end.

1) Front-End

The user interface of a webpage is referred to as the front end, commonly known as client-side. It is the section of the application where the user can access the application's content. The technology that was used to develop the application is described in the following section.

a) *ReactJS:* ReactJS, also known as React or React.js is a front-end library developed by Facebook. It is used to handle the view layer in web and mobile applications. We can construct reusable UI components with ReactJS. It is one of the most widely used JavaScript libraries, with a solid base and a vast community. This full stack application was developed and implemented using React version 16.14.0. ReactJS came into existence in 2011, when Jordan Walke, a software engineer at Facebook created the library. React was influenced by the concept of Component, such as XHP in PHP as an HTML component. The first use of ReactJS was in Facebook newsfeed in 2011. Later, it was picked by Instagram to use it in their system. React was made as an open source by Facebook in May 2013.

2) Back-End

Generally, back-end refers to the server-side which also mean internal working part of the application. This section of the website does not directly interact with users, but it is in responsible of modifying and storing application data. This section contains an explanation of the technology utilised in the development of this application.

a) *Firebase:* Firebase is a cloud database that stores data in JSON and synchronizes with subscription devices in real time. It's an innovative strategy that's both quick and easy to utilise. Firebase is a flexible platform for building mobile and web apps. Firebase serves as the application's back end, handling data storage, user authentication, static hosting, and more. Since being acquired by Google in 2014, Firebase has grown into a strong platform for mobile and online applications. The following section details some of the Firebase services that were implemented throughout the development of the application.

b) *Authentication:* Authentication provides the backend services, easy to use SDKs and ready-made UI libraries to authenticate users to the application. It supports authentication using passwords, phone numbers, emails and other identity providers like Google, Facebook, Twitter and many more.

c) *Cloud Storage:* Cloud Storage is developed for the developer who need to store and serve user- generated content, such as photos, videos, or audios. Cloud Storage for Firebase is simple, powerful, and cost-effective object storage service built for Google scale.

C. Usage

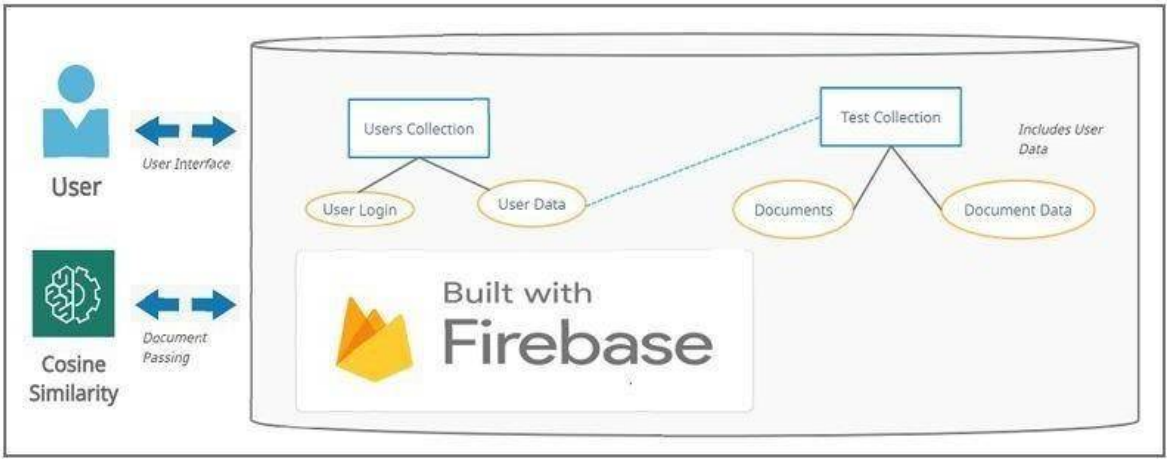
Firebase is cloud storage application which enable us to store data on cloud and use it dynamically. That means retrieve, create, remove, delete data real time dynamically. In our Project, we have used some collection like user, tests and have mapped them to each other in such a way, that every data is mapped and can be retrieved easily. And Firebase also provides authentication module so it helps reduce the work of security and validation.

Here in our project, we made the user collection to store the login credentials and data or information of the user that can be a student or teacher. Each user provides document to store and hence that provided document is been stored in the collection mapped to each other as per user. The document that student brought in Firebase storage bucket is stored with the email and name of the student. Whereas the documents provided by the teacher are mapped with their name and email id.

While retrieving the data the file-path of the document would be found by the users email id and name of the user, which will be available after the user logged in. The user should be logged in for retrieving the data, then only them he/she will be provided with the option of retrieving data.

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Database Architecture:



III. METHODOLOGY

A. Cosine Similarity

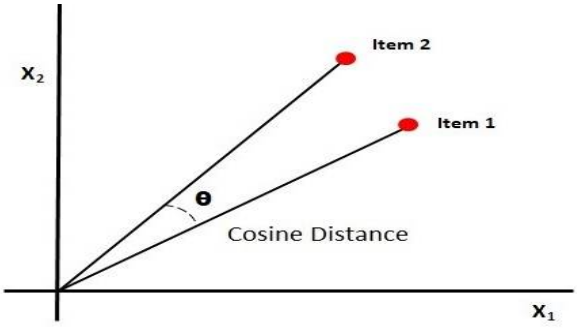
Cosine similarity is a measure of similarity that can be used to compare documents or, say, give a ranking of documents with respect to a given vector of query words. Let *x* and *y* be two vectors for comparison. Using the cosine measure as a similarity function, we have sim(x,y)=x·y||x||||y||,

where ||*x*|| is the Euclidean norm of vector x=(x1,x2,…,xp).

Conceptually, it is the length of the vector. Similarly, ||y|| is the Euclidean norm of vector y. The measure computes the cosine of the angle between vectors x and y. A cosine value of 0 means that the two vectors are at 90 degrees to each other (orthogonal) and have no match. The closer the cosine value to 1, the smaller the angle and the greater the match between vectors. The concept of cosine similarity is used to determine how similar documents are irrespective of their size. Cosine similarity is a mathematical concept that measures the cosine of the angle formed by two vectors projected in a multi-dimensional space. Counting the maximum number of common keywords between documents is a frequent method for matching similar documents. That is, as the size of the document increases, the number of common words tend to increase even if the documents talk about different topics.

The value of cosine similarity is constrained to a range of 0 to 1.

The cosine similarity measures the orientation (the angle) of the documents instead of the magnitude when plotted on a multi-dimensional space where each dimension corresponds to a word in the document. Calculate the Euclidean distance instead if you want the magnitude.



IV. DISCUSSIONS

All of the participants gave our automatic grading systems good ratings. The students appreciated the speedy grading because it allowed them to work on their assessment. It appears to encourage pupils to attempt to pass all of the exam cases by highlighting those who have failed. Demonstrators can spend more time assisting students because of the automated grading tool, which helps them to rapidly understand where they should focus their attention. The consistency of marking, according to lecturers, is a critical characteristic of these technologies because all students grade equally. Moreover, the tracking of all submissions and marks enables module monitoring.

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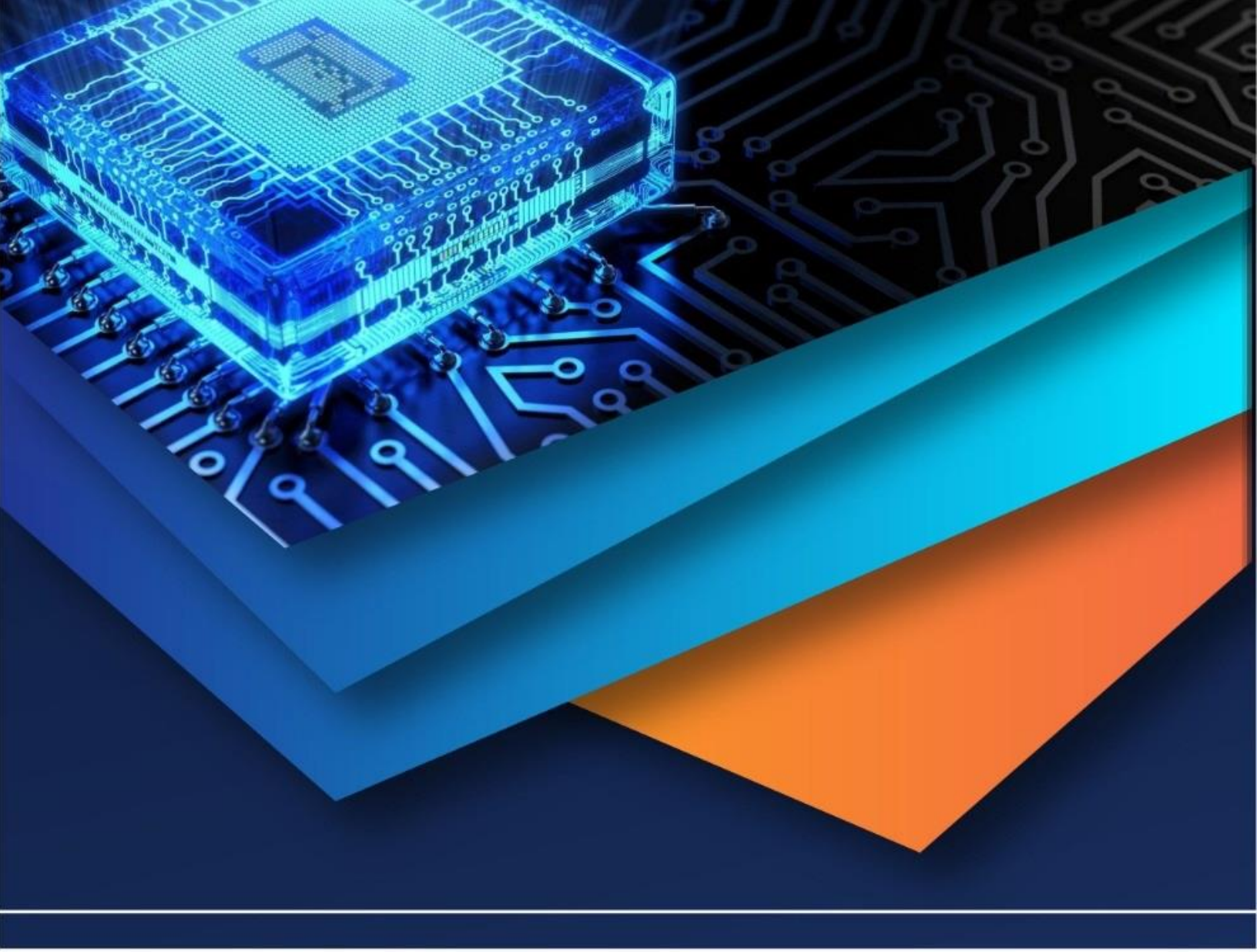
V. FUTURE WORK

In this project, we are currently dealing with a single classroom, but we intend to work on a larger dataset that would be relevant for the entire college or institution. Diagram based document checking would be one of our key goals which will be incorporated in our project in the future.
Additionally, in the meantime, automating the process of handwritten answers will also be addressed.

VI. CONCLUSION

Answer script evaluation is a crucial part of evaluating student performance. A teacher's evaluation of an answer script is usually done manually, which can be discriminatory. The evaluation process is influenced by a range of factors, including the evaluator's mood swings and the inter-relationship between the student and the evaluator. Additionally, evaluating answer sheets is a time-consuming and exhausting activity. Teachers must go to various locations for paper evaluation, and academic institutions must spend a considerable amount of time on all of this. As a result, a high-quality automation system may overcome these restrictions and provide an unambiguous outcome.

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