AI QUESTION GENERATION AND ANSWER EVALUATION SYSTEM

A
Report submitted
in the partial fulfillment of the requirements for the award of the degree of

Bachelor of Technology
in
Computer Science and Engineering

By

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Report

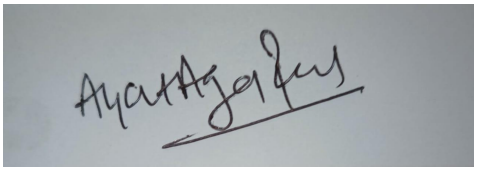
Contents

Declaration

We hereby declare that this submission is our own work and that, to the best of our belief and knowledge, it contains no material previously published or written by another person or material which to a substantial error has been accepted for the award of any degree or diploma of university or other institute of higher learning, except where the acknowledgement has been made in the text. The project has not been submitted by us at any other institute for the requirement of any other degree.

Submitted by: -

Date:



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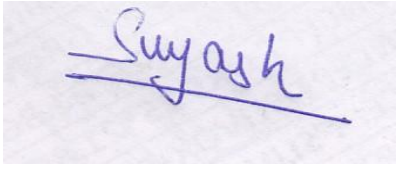

Certificate

This is to certify that the project report entitled “AI Question Generation and Answer Evaluation System” presented by Akshat Agarwal, Ashish Kumar Mishra and Suyash Singh in the partial fulfillment for the award of Bachelor of Technology in Computer Science and Engineering, is a record of work carried out by them under my supervision and guidance at the Department of Computer Science and Engineering at Institute of Engineering and Technology, Lucknow.

It is also certified that this project has not been submitted at any other Institute for the award of any other degrees to the best of my knowledge.

Mr. Natthan Singh

Ms. Priyanka Gautam

Department of Computer Science and Engineering

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We came to know about so many new things, technologies and practices while working on this project. We would also like to thank our peers who in very difficult times helped us and have played a very crucial role in finalizing the project. We also express our sincere gratitude towards the Department of Computer Science and Engineering of Institute of Engineering and Technology, Lucknow for supporting our project idea.

Thank you for all your encouragement and support!

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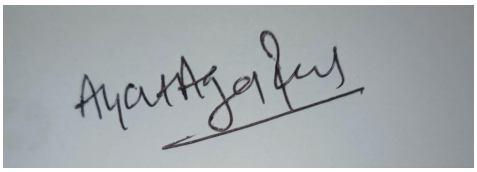

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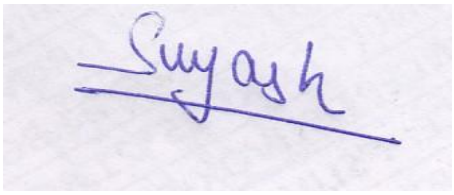


Abstract

The ideal alternative to the current pen-and-paper testing system is to develop a computer-based examination system. E-learning has grown in popularity in recent years as a result of its user-friendliness, adaptability, and integrity. Using an improvised and well-designed question bank, as well as an AI-based examination and evaluation system, this strategy is offered to improve e-learning.

The system is created with varied levels of complexity among the questions, and it also serves as a tool for evaluating the student's replies and grasp of their curriculum. With the right level of protection, this system can save time, be simple to use, and be more efficient.

The suggested methodology is divided into two phases: the design of the question bank and its database, and the construction of an Artificial Intelligence (AI)-based examination system and its evaluation. The addition of theory-based questions and the integration of biometric-based systems can be done in the future to improve the level of security in this system. [5]

List of Figures

Chapter 1

Introduction

Technology reigns supreme in this era. Our daily lives are largely based on technology, from an alarm set on your electronic devices, ordering food from an online app (Swiggy, Zomato which knows all the food we like, the restaurants we prefer all thanks to the beautiful Algorithms being developed) and booking a cab to go back to our places (Uber or Ola which also uses fine algorithms to find the best possible route and the nearest available driver).

Technology is a boon in our lives making it more comfortable, easy and fast. Googling to answer a question is a natural instinct for many people. So, when technology is taking control of every aspect of our lives, why don't we turn to it to answer the problems of Question generation and answer evaluation?

Online exams have gained wider acceptance since the covid hit us hard. When there were no ways to conduct offline pen-paper exams, online exams came to our rescue. There are a lot of advantages to conducting exams online. The first advantage that comes in conducting the exams online is that it is easier to maintain the security of these exams and eliminate any chances of malpractices. There are a lot of chances of human errors in traditional offline exams which may be reduced significantly with online exams.

Traditional, offline handwritten exams include a lot of manual work which is drenching and it includes a lot of coordination between various parties involved (teachers, students,examiners). Since a lot of manual tasks are involved it is prone to human error at various stages. Increasing number of various educational institutions and a high increase in the number of students, conducting exams in the traditional methods have become a hectic process.

Proposed online examinations system gives us a lucrative alternative to traditional pen-paper examinations. Increasing technology is providing us with various solutions to problems which conventional exams face nowadays.
Online examination system helps in conducting the examinations across multiple geographical locations, without the hassle of printing the question papers for each

center. The text for which the student is to be tested is uploaded on the system and this digital format can be encrypted so that it can be protected from hacking.

The proposed examination system has made the process of question generation very easy. Teachers can design different questions for all the students of almost similar difficulty level based on the text entered. The text part for which the student is to be evaluated is entered into the system. The questions (Objective or subjective) are generated from the text entered randomly.

Even the answer evaluation part is done by the proposed system. The objective and subjective answers are evaluated for their correctness based on the factor of matching between the answer entered by the user and the default answer generated from the original text entered by the examiner. The user is shown the results instantly along with the minimum scored marks in that test, the maximum scored marks and the mean score.
The hectic process of answer sheet evaluation and result generation is entirely eliminated.

This project aims to build an automated examination system using Machine Learning, Natural Language Toolkit (NLTK), Python environment, Flask framework and web technologies to provide an inexpensive alternative to the current examination system. We implement a model to automatically generate questions with their respective answers and assess user responses.

Chapter 2
Literature Review

In the last 1–2 years, huge strides have been made in the field of education. Schools and universities are going online in order to give their students more tools. Students now have additional possibilities to learn and progress at their own speed as a result of the COVID-19 epidemic. Online education has grown dramatically in recent years. Massive Open Online Courses (MOOCS) and other online certificate courses are becoming increasingly popular among students. Colleges are now going online to provide their students with more resources. There has also been an increase in the number of people who are launching their own courses. All of this provides pupils with greater opportunity to study and grow. Li et al. (Li et al., 2015). The user's privacy is a major problem in all of these systems. When such a system is used, it has access to the students' audio and video input. Some systems can also identify and limit the activity of other programs operating in the background. While all of this is done to ensure a secure and fair test-taking environment, some may regard an institution having access to all of a user's data to be a huge invasion of privacy. [1]

Artificial Intelligence (AI) and Machine Learning (ML) are the next technological crown jewels. Artificial Intelligence has infiltrated our daily lives in such a way that we may have missed it. Customers utilize AI more than they know; whereas 77% of consumers use AI-powered products, only 33% are aware that they are doing so. Because AI has so many benefits and applications, it has also found its way into the education industry. AI is revolutionizing the education sector, from supporting instructors with administrative tasks such as taking attendance and grading assignments to providing teachers with feedback by assessing student performance in tests. AI is also changing the way we administer online exams, making them more secure and convenient to administer. [2]

The development of a computer-based examination system is a replacement for the current paper-based examination system. Because of its adaptability, integrity, and user friendliness, e-learning has grown in popularity in recent years. The following are the primary goals of the suggested intelligent-based assessment system:

1. To gain an understanding of how to conduct and supervise online exams among students.
2. To understand the many substructures that are employed to examine the online based intelligent systems examination. This entails researching the company's

operating aspects as well as the working environment.

3. To come up with an intelligent process for conducting and evaluating it.
4. Modification of the current examination system in accordance with the suggested examination methodology.[3]

Advantages of the proposed system

- A more accurate and fair assessment of the test-skill taker's level.
- A clearer picture of one's areas of expertise and areas where one falls short.
- A totally digital approach that dramatically decreases the use of paper.
- When compared to present approaches, near real-time evaluation takes into account the reduction in latency between the evaluator and the test-taker.
- An intelligent system that anticipates the test-ability taker's as he responds to questions.[4]

Chapter 3

Methodology

When we think about schools and universities, what comes to mind?

A classroom full of pupils frantically scribbling notes while a teacher drones on about a subject that is "very crucial for your midterms."

Exams are an important and necessary element of the educational process. They are significant turning points in a student's academic career, and students are understandably anxious about them.

The proposed examination system makes the task of examination hassle free. All the activities from question paper generation, to answer evaluation and calculation of mean score of the class is done by this system.

Modules and Libraries Used

1) **NumPy**

   NumPy may be used to conduct a wide range of array-based mathematical operations. It extends Python with sophisticated data structures that ensure fast computations with arrays and matrices, as well as a large library of high-level mathematical functions that work with these arrays and matrices.

2) **Flask**

   Flask is a Python-based microweb framework. It is referred to as a microframework since it does not necessitate the usage of any specific tools or libraries. It doesn't have a database abstraction layer, form validation, or any other components that rely on third-party libraries to do typical tasks.

3) **Pandas**

Pandas is a widely used open source Python library for data science, data analysis, and machine learning activities. It is developed on top of Numpy, a library that supports multi-dimensional arrays. Pandas, as one of the most popular data wrangling programmes, is normally included in every Python distribution, from those that come with your operating system to commercial vendor versions like ActiveState's ActivePython.

4) **NLTK**

NLTK is a Python toolbox for working with natural language processing. It supplies us with a variety of text processing packages as well as a large number of test datasets. Tokenizing, parse tree visualization, and other operations may be accomplished with NLTK.

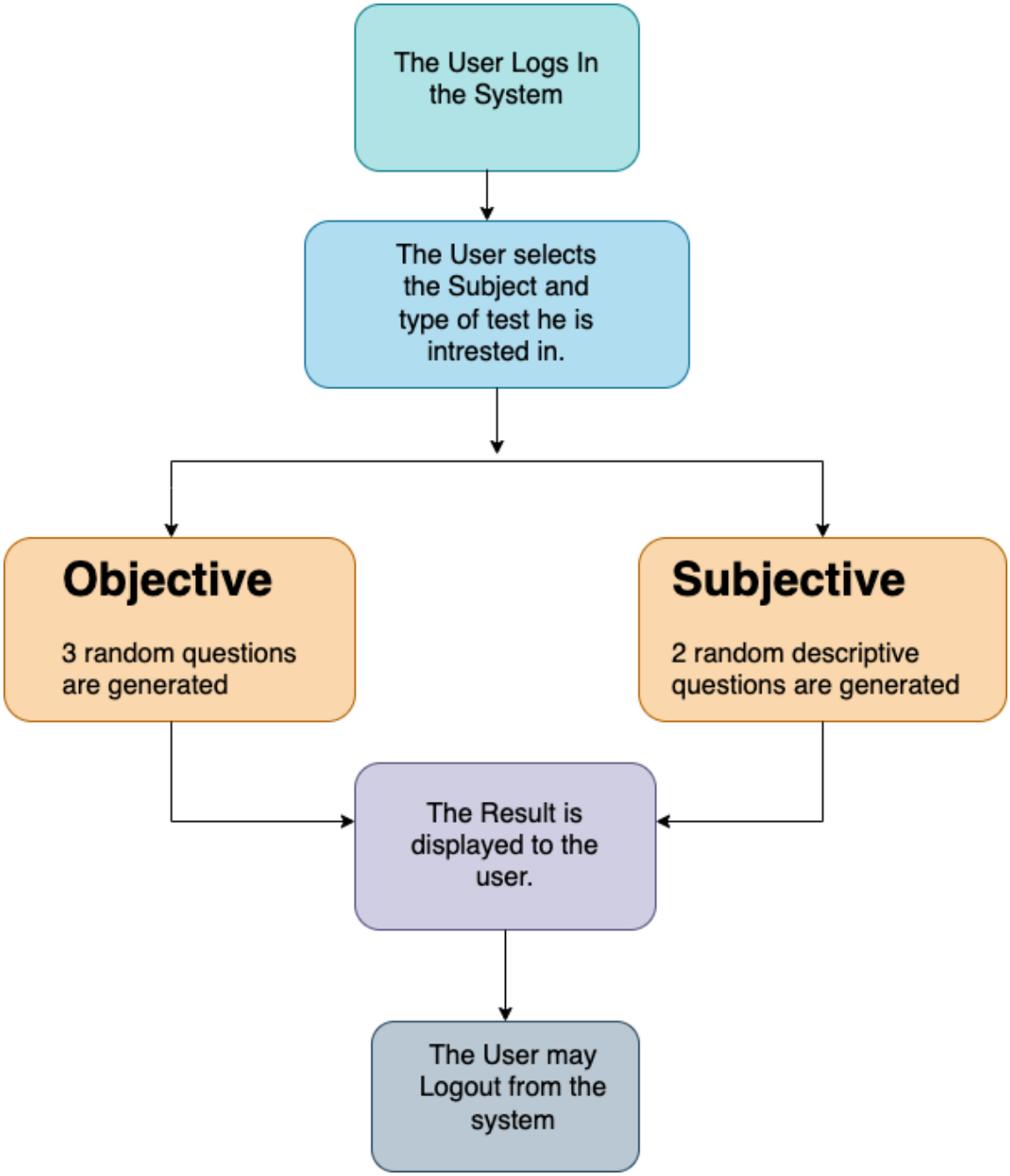
Process:

The test taker selects the type of test he is interested in giving i.e. objective or subjective. Based on the selection the questions are generated.

If an objective test type is chosen, three questions appear where the user has to fill in the blank with the correct answer. On submitting the test the result for that particular test is generated along with max score scored in that test, the minimum score and the mean score of all the test takers.

If a subjective test is chosen, two questions appear where the user has to manually type the descriptive answer of that question.
On submitting the test the score is evaluated by comparison of the user answer with the default answer along with max score scored in that test, the minimum score and the mean score of all the test takers.

Flowchart of the Process:



Steps in Text Processing:

1. Tokenization
2. Lower case conversion
3. Stop Words removal
4. Stemming
5. Lemmatization
6. Parse tree or Syntax Tree generation
7. POS Tagging

Tokenization:

Tokens are short chunks of text that are broken down into smaller components. Tokens make up a little portion of the text. If we have a phrase, the goal is to isolate each word and develop a vocabulary that allows us to express each word in a list separately. Tokens include numbers, words, and other objects. [5]

Lower case conversion:

We don't want our model to be confused when it sees the same term in different circumstances, such as one that starts with a capital letter and one that doesn't, and interpret them differently. To eliminate repetition in the token list, we transform all words to lowercase.

Stop Words removal:

When we employ text characteristics to model, we will come across a lot of noise. These are stop terms like the, he, her, and so on that don't help us and should be deleted before processing for a cleaner model. We can view all of the stop words in the English language using NLTK..

Stemming:

Many terms in our text with the root word play, such as playing, played, playfully, and so on, all communicate the same sense. As a result, we may simply extract the basic word and discard the remainder. The produced root word is referred to as stem,' and it is not required that stem exist and have a meaning. We may produce stems just by committing the suffix and prefix.

Lemmatization:

Here, we're looking for the word's root form. The word retrieved here is Lemma, which may be found in a dictionary. The lemma developed will be available in the WordNet corpus, which we already have. The WordNet Lemmatizer is a tool provided by NLTK that searches the WordNet Database for lemmas of words.

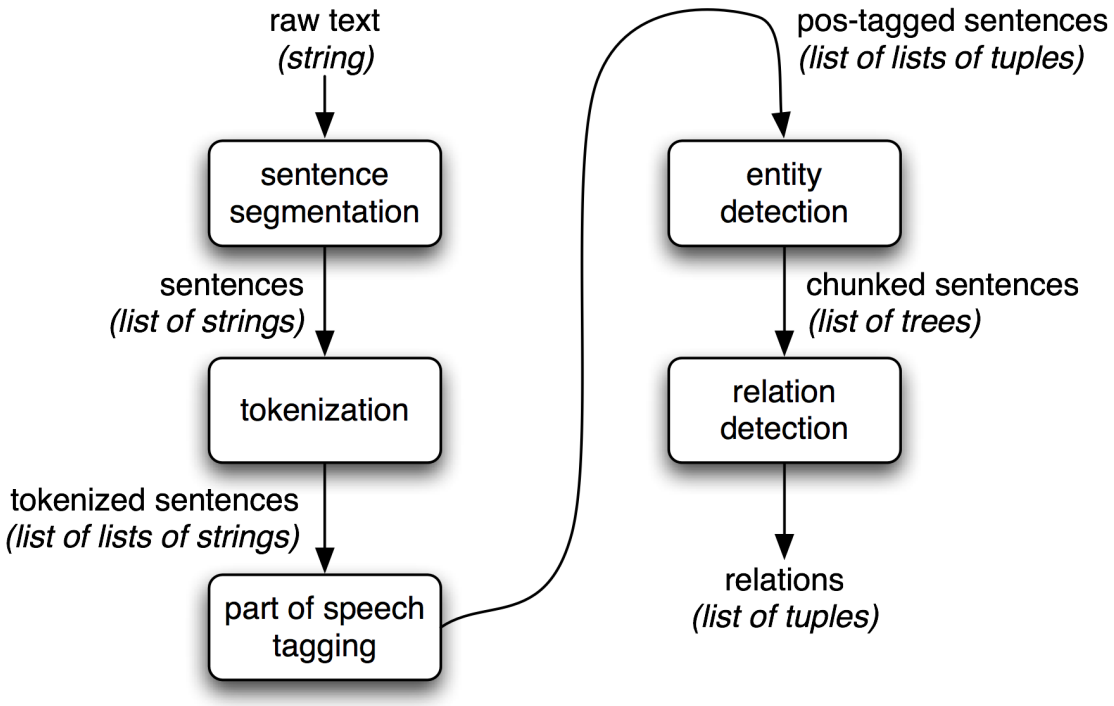
Parse tree or Syntax Tree generation :

We may create grammar and then use NLTK RegexpParser to extract all elements of speech from a phrase and visualise them using functions.

POS Tagging:

In text processing, part of speech tagging is used to eliminate misunderstanding between two words that have distinct meanings. We assign each word a specific tag and analyse it based on its definition and context. [6]

NLTK Sequence:

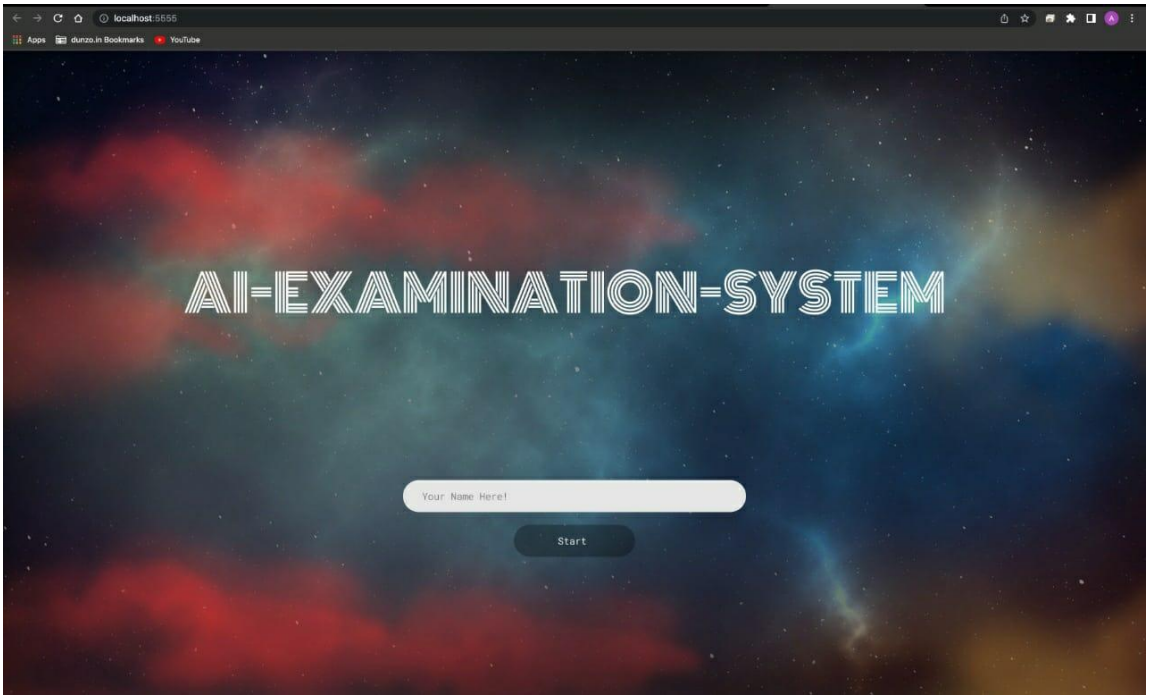


Chapter 4

Experimental Results

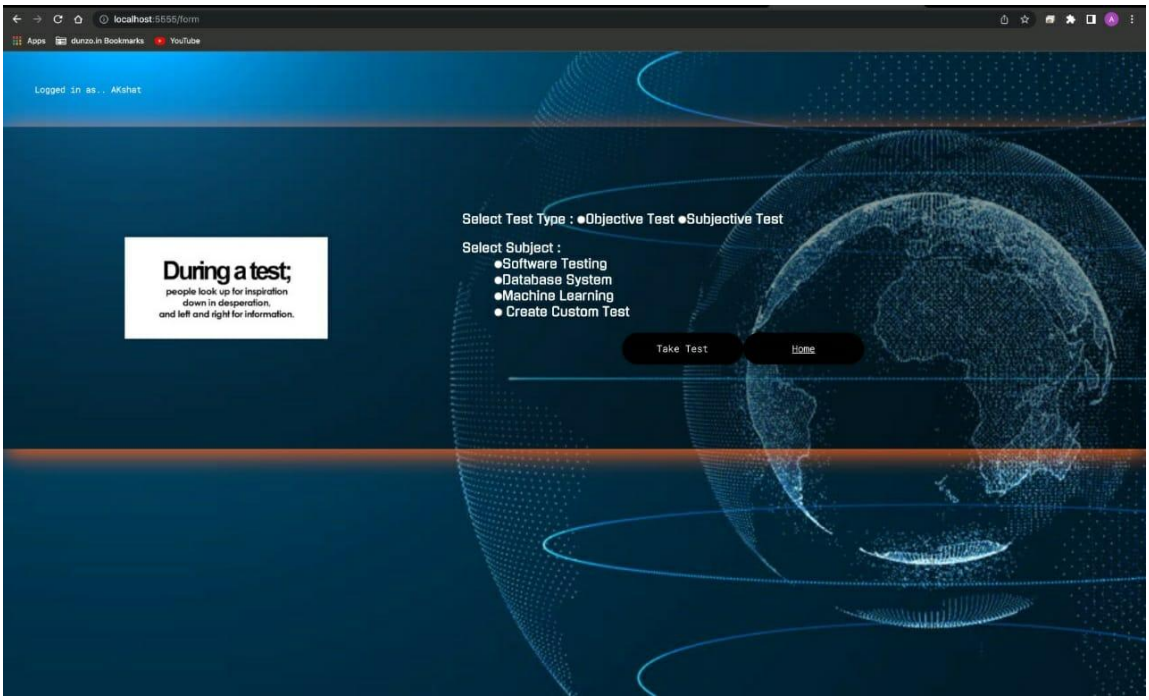
LOGIN PAGE:

At the login page or home page, users can enter their name then click on the start button to enter into the exam zone.



CHOOSING EXAM TYPE AND SUBJECT:

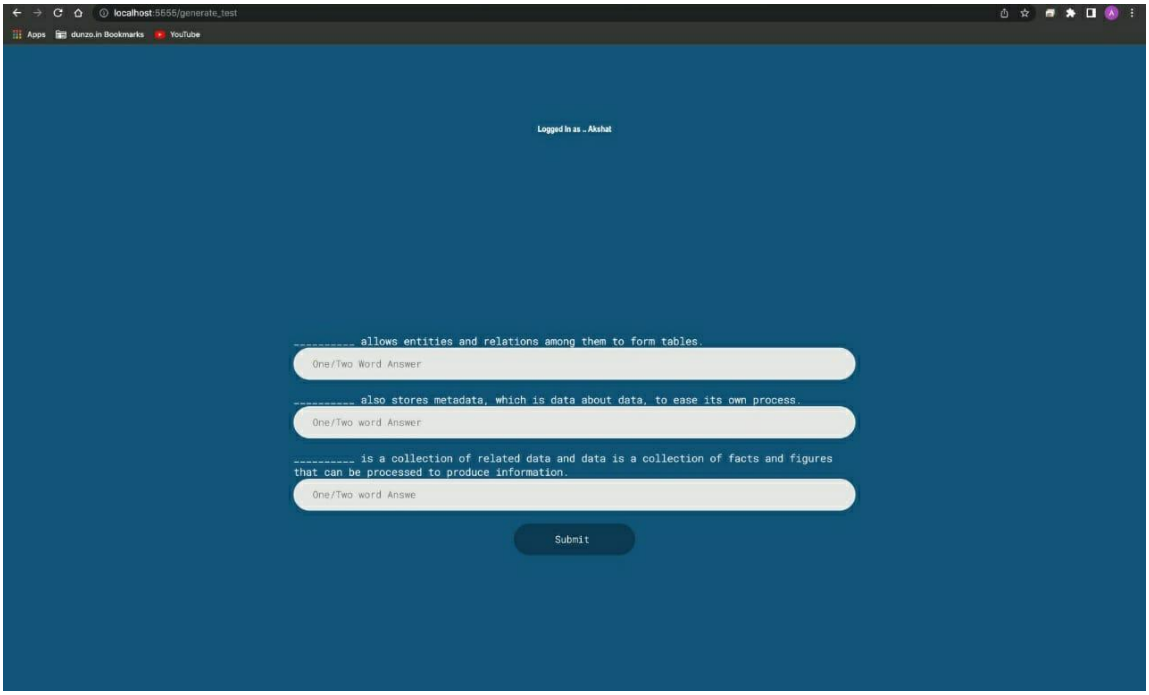
After starting the exam, users will see the below page in which they can choose the exam type and subject for which they want to give the exam. They can also create their custom test for their desired subject. Afterwards they are good to take the test.

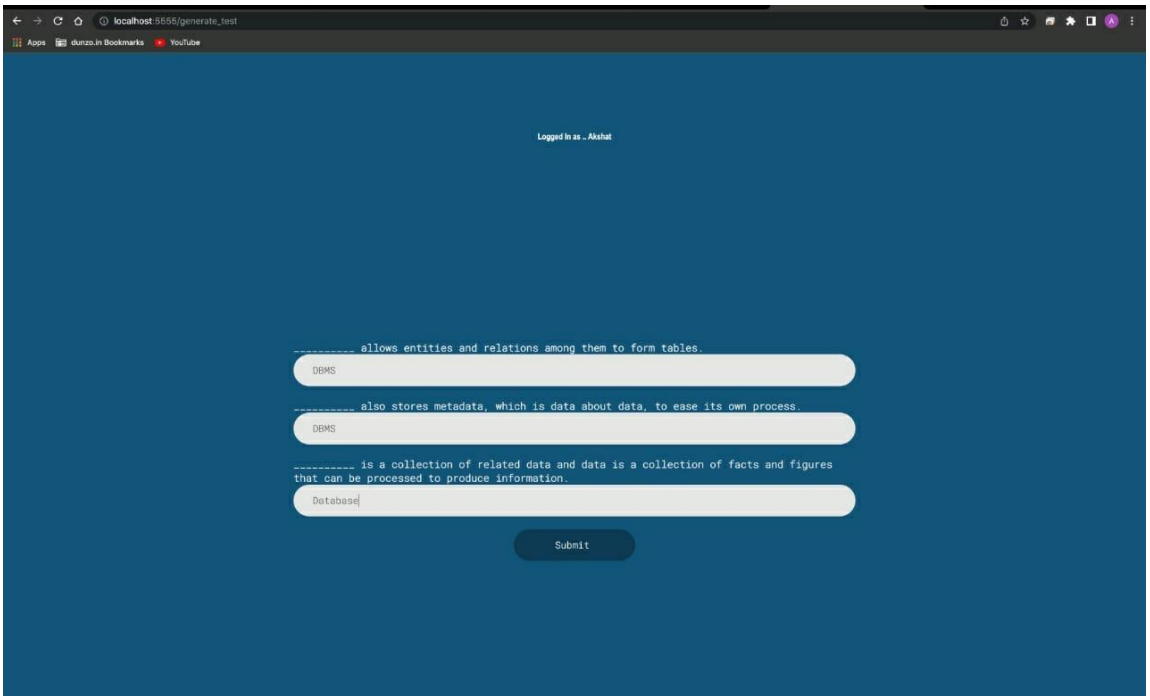


OBJECTIVE EXAM PAGE:

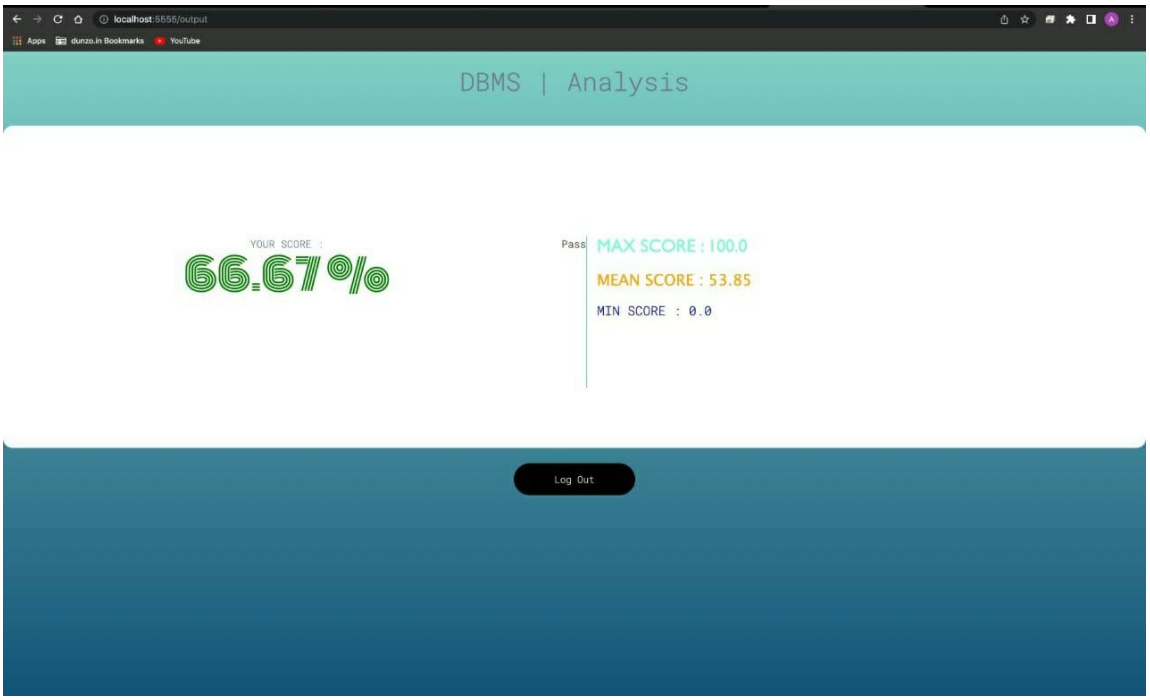
If a user decides to take an objective exam for a subject, then the below page will appear and the user has to give the answer in desired format i.e in one word or two word answer.

After giving all the answers, users can submit the test to check their score.




localhost:5555/generate_test
Apps
dunzo.in Bookmarks
YouTube
Logged in as .. Akshat
_____ allows entities and relations among them to form tables.
DBMS
_____ also stores metadata, which is data about data, to ease its own process.
DBMS
_____ is a collection of related data and data is a collection of facts and figures that can be processed to produce information.
Database
Submit

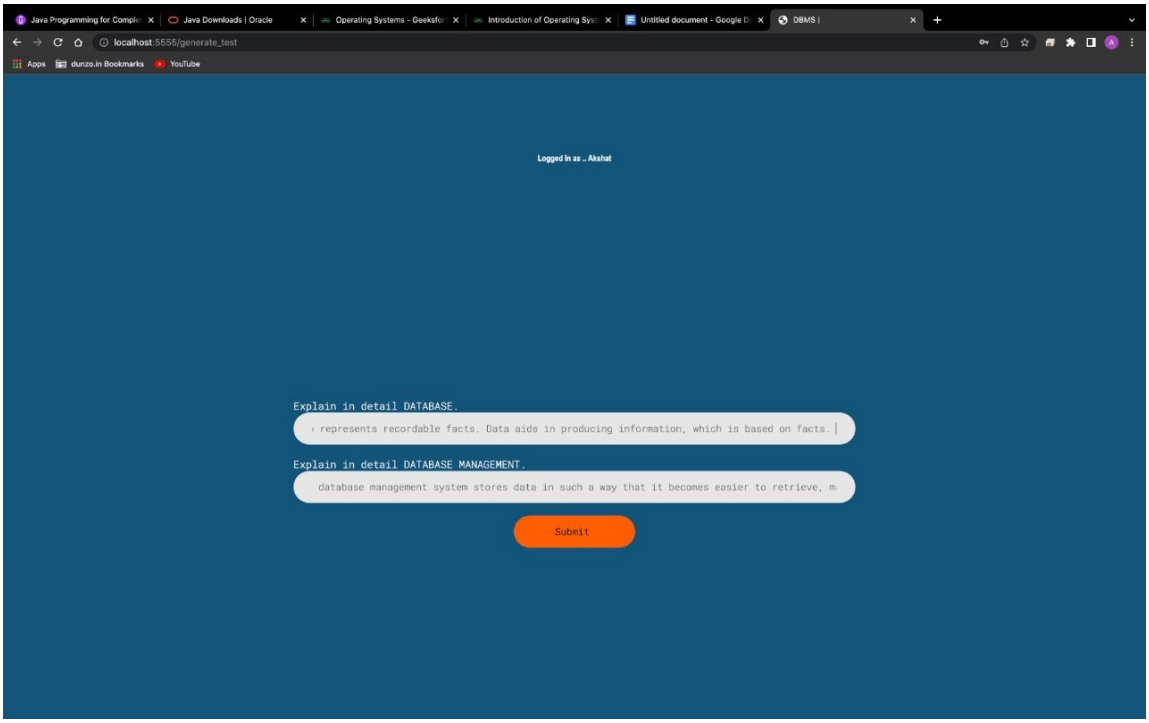
Result Page:


localhost:5555/output
Apps
dunzo.in Bookmarks
YouTube
DBMS | Analysis
YOUR SCORE :
66.67%
Pass
MAX SCORE : 100.0
MEAN SCORE : 53.85
MIN SCORE : 0.0
Log Out

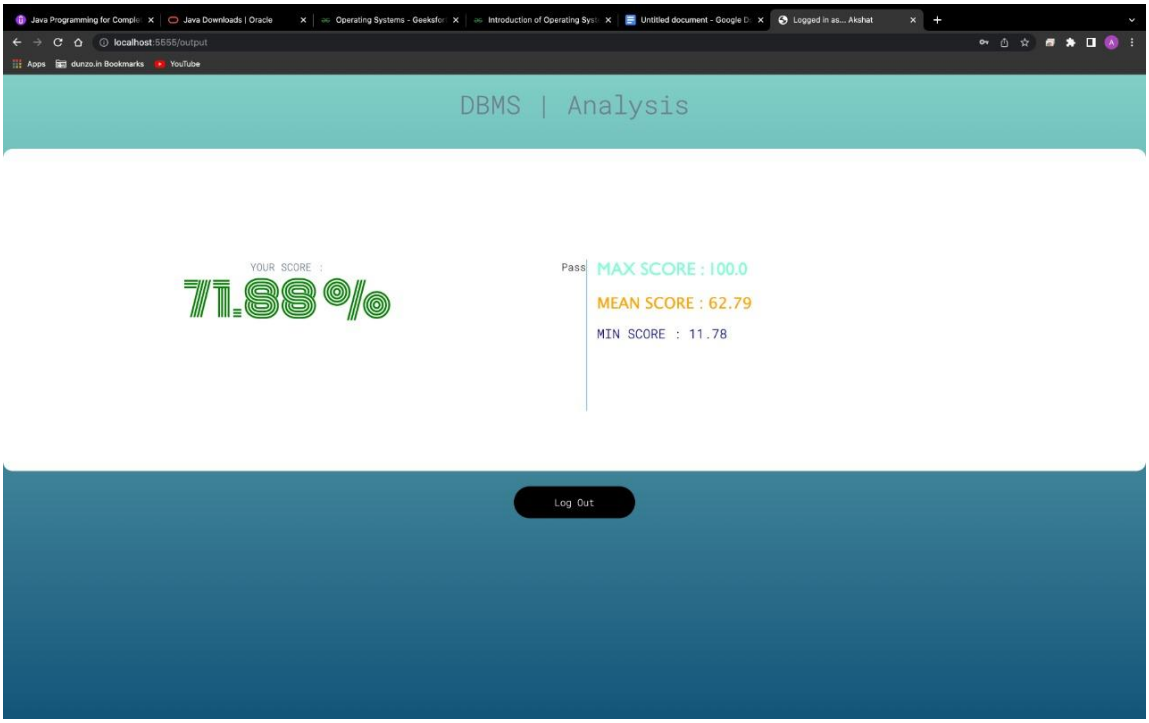
SUBJECTIVE EXAM PAGE:

If a user decides to take a subjective exam for a subject, then the below page will appear and the user has to give the answer in a subjective format like a short note.

After giving all the answers, users can submit the test to check their score.



Result Page: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Java Downloads | Oracle
Operating Systems - Geeksfor
Introduction of Operating Syst
Untitled document - Google D
Logged in as... Akshat
localhost:5555/output
Apps
dunzo.in Bookmarks
YouTube
DBMS | Analysis
YOUR SCORE :
71.88%
Pass
MAX SCORE : 100.0
MEAN SCORE : 62.79
MIN SCORE : 11.78
Log Out

Randomness Analysis (Questions)

Sample Text:

Database is a collection of related data and data is a collection of facts and figures that can be processed to produce information. Mostly data represents recordable facts. Data aids in producing information, which is based on facts.

A database management system stores data in such a way that it becomes easier to retrieve, manipulate, and produce information.

Traditionally, data was organized in file formats. DBMS was a new concept then, and all the research was done to make it overcome the deficiencies in traditional style of data management.

A modern DBMS is more realistic and uses real-world entities to design its architecture. It uses the behavior and attributes too.

For example, a school database may use students as an entity and their age as an attribute.

DBMS allows entities and relations among them to form tables. A user can understand the architecture of a database just by looking at the table names.

A database system is entirely different than its data. A database is an active entity, whereas data is said to be passive, on which the database works and organizes. DBMS also stores metadata, which is data about data, to ease its own process.

DBMS follows the rules of normalization, which splits a relation when any of its attributes is having redundancy in values. Normalization is a mathematically rich and scientific process that reduces data redundancy.

Consistency is a state where every relation in a database remains consistent. There exist methods and techniques, which can detect attempt of leaving database in inconsistent state.

A DBMS can provide greater consistency as compared to earlier forms of data storing applications like file-processing systems.

DBMS is equipped with query language, which makes it more efficient to retrieve and manipulate data. A user can apply as many and as different filtering options as required to retrieve a set of data. Traditionally it was not possible where file-processing system was used.

A database-management system (DBMS) is a computer-software application that interacts with end-users, other applications, and the database itself to capture and analyze data. A general-purpose DBMS allows the definition, creation, querying, update, and administration of databases. Formally, a "database" refers to a set of related data and the way it is organized.
An entity is any object in the system that we want to model and store information about. Entities are usually recognizable concepts, either concrete or abstract, such as person, places, things, or events which have relevance to the database.

ACID acronym stands for the properties maintained by standard database management systems, standing for Atomicity, Consistency, Isolation, and Durability.

A situation in which resources (i.e. locks) are held by two or more connections that are each needed by the other connections so that they are stuck in an infinite wait loop is called Deadlock.

A database in which inter-table relationships are organized primarily through common data columns, which define a one-to-many relationship between a row of the primary key table and one or more rows of the matching foreign key table.

An embedded database is the combination of a database and the database software which typically resides within an application. The database holds information and the software control the database to access or store information. The application software, or the user-interface, then accesses the database and presents that information in a way which is easy for the user to interpret and understand. When a snapshot of the database is taken, an instance of the database is frozen and concurrent reads are allowed to occur.

Analysis of the Text:

Words: 601
Character: 3763
Characters excluding spaces: 3180

Objective questions generated in the first 5 runs.

1st Run.

Q1. _____ are allowed to continue while reads on the snapshot are happening.

Q2. Locks are held by two or more connections that are each needed by the other connections so that they are stuck in an infinite _____ is called Deadlock.

Q3. _____ in producing information, which is based on facts.

2nd Run

Q1. _____ is a collection of related data and data is a collection of facts and figures that can be processed to produce information.

Q2. _____ are allowed to continue while reads on the snapshot are happening.

Q3. _____ also stores metadata, which is data about data, to ease its own process.

3rd Run

Q1. _____ is a collection of related data and data is a collection of facts and figures that can be processed to produce information.

Q2. _____ in producing information, which is based on facts.

Q3. _____ are allowed to continue while reads on the snapshot are happening.

4th Run

Q1. Locks are held by two or more connections that are each needed by the other connections so that they are stuck in an infinite _____ is called Deadlock.

Q2. _____ in producing information, which is based on facts.

Q3. _____ is a collection of related data and data is a collection of facts and figures that can be processed to produce information.

5th Run

Q1. _____ are allowed to continue while reads on the snapshot are happening.

Q2. _____ in producing information, which is based on facts.

Q3. _____ is a collection of related data and data is a collection of facts and figures that can be processed to produce information.

In the above five runs of question generation, 5 questions are getting repeated in total 15 numbers of different questions generated.
So, after testing this for 100 different runs, we came to a conclusion that 45% of questions are getting repeated in 300 different questions.

Subjective questions generated in the first 5 runs.

1st Run

Q1. Explain in detail ACID.

Q2. Explain in detail ISOLATION.

2nd Run

Q1. Explain in detail RELATIONSHIP BETWEEN A ROW.

Q2. What do you mean by DEADLOCK.

3rd Run

Q1. Write a short note on ATOMICITY.

Q2. Explain in detail SNAPSHOT OF THE DATABASE.

4th Run

Q1. What do you mean by DEADLOCK.

Q2. Explain in detail ACID.

5th Run

Q1. Define DATABASE MANAGEMENT SYSTEM.

Q2. Explain in detail ACID.

In the above five runs of question generation, 2 questions are getting repeated in total 10 numbers of different questions generated.
So, after testing this for 100 different runs, we came to a conclusion that 40% of questions are getting repeated in 200 different questions.
If the length of the given text is significantly increased, then the number of different questions also increases.

Chapter 5

Conclusion

An artificial intelligence (AI) examination system is presented as a means of enhancing e-learning systems. User administration, course management, question and answer management, and examination and evaluation management are the four components that make up the proposed system. All of the modules in the proposed system are carried out using an AI-based algorithm. Because it is taught and tested by an AI-based system, the suggested system is intelligent. Questions are created depending on the students' ability levels, and marks are awarded based on the relevancy of the answers. Because the proposed system employs authentication techniques throughout the process, it is more secure. The entire system is set up in such a manner that the examinations may be done more simply with the help of a computer. All four components of the proposed system are subjected to the AI-based algorithm. The addition of theory-based questions and the integration of other security measures such as biometric-based systems can be done in the future with this system.

5. 2 Future Works

1. Currently, a user is logging through his name and the project does not have an authentication method applied to verify the users which is an important aspect of this project considering it would be used to assess examination scores for different users. Addition of a proper authentication system i.e. through a user's mobile number could be used to uniquely identify and register them. Users will receive OTP on their registered mobile numbers to login the application. Only registered users should be able to give the test and the user must be able to take only those tests which he is eligible to give.

2. The project does not have any proctoring mechanisms currently. There are plans to add a proper proctoring system to this application. It will include sharing of screens and access to audio and video of the candidate to monitor his/her actions during the examination. Initially the proctoring can be done manually through invigilators and can be done by AI iteratively.

3. Currently subjective answer evaluation is done using the NLTK library i.e. we use Tokenization, Stemming, Lemmatization and Syntax Tree Evaluation to assess the user's answers and output the result. The current approach definitely fulfills short term goals of our project but for its large scale implementation would be working to develop an algorithm that focuses on keyword based evaluation rather than just default answer text. Also the answer should make sense and just having keywords should not be correct.

4. To increase the scope of the proposed system from primary school courses to degree courses.

5. Current system works well on theoretical courses question generation and their answer evaluation but we plan to expand its scope to non-theoretical courses i.e. mathematics, etc.

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