E-Learning System for Detection of Learning Disability

Submitted in partial fulfillment of the requirements of the degree

of

Bachelor of Engineering

in

Computer Engineering

by

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2019-2020

CERTIFICATE

This is to certify that the project entitled **E-Learning System for Detection of Learning Disability** is a bonafide work of the following students, submitted to the University of Mumbai in partial fulfillment of the requirement for the award of the degree of **Bachelor of Engineering** in **Computer Engineering**.

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PROJECT REPORT APPROVAL

This project report entitled ***E-Learning System for Detection of Learning Disability*** by following students is approved for the degree of **Bachelor of Engineering** in **Computer Engineering.**

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DECLARATION

We declare that this written submission represents our ideas in our own words and where others ideas or words have been included, We have adequately cited and referenced the original sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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ACKNOWLEDGEMENT

We wish to express our deep sense of gratitude and thank our Internal Guide and our Project coordinator, Prof. Masooda Modak for her guidance, help and useful suggestions, which helped in completing our project work in time. We also thank our HOD, Dr. Aparna Bannore for her support in completing the project.

We also thank our Principal Dr. Atul Kemkar, for extending his support to carry out this project. Also we would like to thank the entire faculty of Computer Engineering department for their valuable ideas and timely assistance in this project, last but not the least, we would like to thank our teaching and non teaching staff members of our college for their support, in facilitating timely completion of this project.

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ABSTRACT

This project titled **E-Learning System for Detection of Learning Disability** is our approach for solving some of the problems faced by students having Learning Disability. It sheds some light into introducing the issue of Learning Disability to the readers and later follows that with some study on the existing systems for detecting and curing this problem. We have later proposed our model for the same which involves many parameters and we have focused on Dyslexic students. So, the parameters considered here are those with respect to Dyslexia. This project gives a clear picture of our model through the framework and later highlights the algorithm or computation behind the detection process. The project gives clarity in terms of the step by step approach towards detection which is very crucial. The project also provides information with respect to the testing done, their results followed by the analysis of the same. In the end, we also give the readers a briefing about what this project has successfully achieved overall and our plans for the future.

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List of Abbreviations

ANFIS	Adaptive Neuro-Fuzzy Inference System
ANN	Artificial Neural Networks
BBN	Bayesian Belief Networks
CSP	Computer Science Principles
E-Learning	Electronic Learning
FN	False Negative
FP	False Positive
LD	Learning Disability
LMS	Learning Management System
LO	Learning Object
ML	Machine Learning
Non-LD	Non Learning Disability
PCA	Principle Component Analysis
SVM	Support Vector Machine
TN	True Negative
TP	True Positive

CHAPTER 1
INTRODUCTION

1.1 Introduction

With the advancements in technology the term "E-Learning" has become very popular and in a few years time might become the norm in the education sector. Students and learners of various other age-groups have been and still are benefiting from this mode of learning due to simple fact that it is convenient. "Learning at your own pace" and "getting certified from home" are some of the cliched terms used nowadays. However, our topic focuses on not just E-Learning as a whole but it is specific to students having LDs.

LD is a disorder affecting the nervous system. To put it simply, it is the different way in which a person's brain works. Children having LDs are not necessarily dim-witted than their counterparts but have difficulty in reading, writing, reasoning, recalling, organizing information or understanding on their own. They also find it hard to learn in normal or regular pace like others. We are focusing on detecting and attempting to solve some aspects of Dyslexia which is difficulty in reading and is one of the more commonly known LDs.[1]

The study of LD focuses on identifying the conditions that affect the student's personal development and justify the provision of certain aids or special services, such as adaptations to the tools they can use for certain processes, for example, adaptations to access, assistance, intervention, and learning.[2]

Learning Disability(LD) according to the WHO's International Classification of Diseases the LD are known as "Specific developmental disorders of scholastic skills" and are classified as follows:[3]

- Specific reading disorder.
- Specific spelling disorder.
- Specific disorder of arithmetical skills.
- Other developmental disorders of scholastic skills.
- Developmental disorder of scholastic skills.
- Mixed disorder of scholastic skills.

1.2 Motivation

This project is a current need due to the following reasons:

- The current system of formal testing in hospitals is a very tedious and time consuming process. It is a very long and convoluted test for which an application form is needed to be filled first to get the appointment.The problem gets compounded when we consider the fact that very few government hospitals perform this testing and provide the legal certification for LD.
- While giving these tests, the children quite often aren't aware of some difficulty that they have or are unable to express it. Also, there is a hesitation to accept the fact that they have a disability and there is a problem of inapplicable questions as well.

- The society in which these children live also is not open towards accepting these children in general and they are not understood by others thus, labelled and not treated with extra care they deserve.

The above issues lead to creating this project where can create a system that takes in the student's input and analyses it, to adapt as per the difficulty/disability of the user. The idea is to make the user feel comfortable by providing user friendly interface and make the user feel as if they are just giving some other normal test. Finally, the need of the project lies in boosting the confidence and morale of students having LDs and to solve or teach them to overcome their disability so that they don't feel neglected.

1.3 Scope

In this project, we have focused on the children with LD belonging to the age group 11-13 i.e grade 6-8 due to them being LD certified. Currently, the scope involves detecting the LD called Dyslexia which pertains to reading difficulty. It involves students attending certain courses designed to capture certain parameters with respect to the difficulty aspects.

1.4 Project Schedule

This project's schedule is as shown in Figure 1.1

Figure 1.1: Gantt Chart

1.5 Organization of Report

The report is organized into six chapters. The first chapter i.e. the current chapter is the Introduction which comprises of brief introduction to the topic, this topic's need, the scope and the schedule. The second chapter is Literature Survey which includes the the survey of existing systems, their limitations, the current problem statement and it's objectives. The third chapter called Proposed System gives information about the system created here and it's framework. The fourth chapter is Design & Methodology which shows the design, gives details on the methodology, algorithm used and it's analysis followed by hardware/software requirements. The fifth chapter called Results & Discussions elaborates the implementation process followed by the testing of the system, the results obtained and their analysis. The 6th chapter i.e. the final chapter is Conclusion & Future Scope where we briefly summarize the working and the results followed by the future plans to extend this project.

CHAPTER 2
LITERATURE SURVEY

2.1 Existing Systems Survey

2.1.1 Learning Disability

In the paper titled "Exploratory Research to Expand Opportunities in Computer Science for Students with Learning Differences" [4], the authors aim to make the CSP course more accessible for students who learn differently. They have provided a list of specific learning and attention deficit disorders and the underlying psychological processes typically associated with them. For people with Reading disorders, the problems faced could be with respect to decoding, fluency or comprehension. The underlying psychological processes typically associated with it are Phonological awareness, Retrieval fluency and Processing speed. For people with written expression disorders, the problems faced could be with respect to spellings, grammar of the sentences and punctuation. They could also be unclear or unable to organize the written expression. For math disorders, the problems faced could be with respect to number sense, memorization of arithmetic facts ,accurate math reasoning, visual perceptual reasoning, cognitive flexibility pattern recognition.

In the paper titled "Arithmetic Abilities in Children With Developmental Dyslexia: Performance on French ZAREKI-R Test" [5], the authors mention three main methods to support the hypothesis that weak phonological representations affect aspects of mathematics involving the manipulation of verbal codes in individuals with dyslexia. First, phonological processing

abilities account for arithmetic attainment. Phonological similarity of the oral addition problems has effect on both speed and accuracy. Association between phonological awareness and small size arithmetic problems requires a retrieval strategy. Second, individuals with dyslexia have weak phonological processing and weaknesses in aspects of mathematics that involve the manipulation of verbal code. Third, the neurological circuits that control verbal aspects of mathematics are impaired in individuals with dyslexia. The findings indicate a high frequency of arithmetic deficits in children with dyslexia. These different patterns result from individual trajectories of development and arithmetic learning.

A Report from the National Joint Committee on Learning Disabilities, titled "learning disabilities and young children: identification and intervention" [6], discusses about early identification and intervention, services and supports for young children, who demonstrate delays in development that may place them at risk and could be later identified as having a LD. There could be delayed development in perception, communication, emergent literacy or motor and sensory abilities. It explains that the risk indicators do not compulsorily indicate slow learning problems or indicate the presence of a disability, especially when only a single indicator is present. Likewise, the protective factors do not guarantee absence of a disability. However, the existence of risk indicators requires considerable and legitimate efforts to enable early learning success, because many children at risk respond positively to high-quality instruction and support. Thus, children who are at risk, who may or may not have LD, should receive cautiously planned, receptive services and support to improve their opportunities for learning.

2.1.2 Adaptive E-Learning

In the paper titled "Dynamic learner profiling and automatic learner classification for adaptive e-learning environment." [7], an adaptive learning environment was provided by the authors. This environment catered to the varying needs and performance and behavior of the learner. Learners' behavior over a period of time was used to analyze through navigation logs. Based on their performance and knowledge level, the learners were classified. According to their needs and characteristics the learning content was offered to the learners. The profiling parameters considered by them were varying learner behaviors, learning styles, knowledge level, learner's state, learner's goals, their preferences and performances, content difficulty, and feedback. The authors classified the learners using the BBN and decision tree techniques, which also helped to build the profile based on the performance and the knowledge level of the learner.

The authors in "Adaptivity and Personalization in Learning Systems based on Students' Characteristics and Context" [8], focused on six characteristics of learners: the learning styles, cognitive traits, affective states, motivational aspects, and the context/environment of learners. They enabled mobile systems to understand the learners' environment and provided him/her with learning objects/activities that worked best in such environments. Thus, depending on the environment of the learner (silent or noisy, stationary or moving) the learning objects were provided to the learner.

The authors in the paper titled "Dynamic Composition of Curriculum for Personalized E-Learning" [9], generated the e-learning course to cater for the different learning needs of the learners. The majority of users were accustomed to expressing their learning needs in terms of keywords, and

thus they provided the user interface enabling the learners to express their learning needs in terms of keywords during the learning process, but at the same time they used the semantic information regarding the application domain to obtain results that were not possible in traditional information retrieval. In addition to the keywords, the learners could specify other constraints, such as difficulty level, learning time, media type, etc. In this way, learners were able to actively drive the selecting and organizing of learning materials to meet their own learning needs. For the given query proposed by the learner, the course composition was fulfilled by the five-step process involving Query annotation, LOs searching, Topic mapping, Learning syllabus planning and lastly LOs sequencing. The target learning objects were sequenced and provided for the learners to address their focused and personalized learning needs.

2.1.3 Detection of LD

In the paper titled "Learning disabilities in a population-based group of children with hydrocephalus" [10], a population consisting of a group of children were assessed on their cognitive functioning having hydrocephalus and were distinguished and analysed on the basis of having myelomeningocele (MMC) or not. Other cases in this population involved those who had hydrocephalus by birth and those born either full term or preterm. The Wechsler Intelligence Scales were used to assess 73 children out of 103 who had hydrocephalus and belonged to the western-Swedish region in 1989 to 1993. As per the results, normally gifted children (IQ485) were 33% of the total, whereas 37% had IQ of 57 and LDs. A low average IQ of 70 to 84 was found in 30% of the children. For the children who had hydrocephalus,

their cognitive functioning has to be very cautiously examined before they are of school age so that they get enough help and education. Because of comparatively better verbal ability but heavily weakened non-verbal and perceptual abilities, these 33% of children who are almost normal having an IQ of 70 to 84, also need distinctive attention.

In this paper titled "Detecting specific learning disabilities" [11], the expected model is a Web-based tool involving machine learning methods such as Decision trees to predict whether 8-10 year old children have some form of LD by pointing to the LD areas based on clinical research. This tool is focused on bringing the parents, teachers to light about the fact that their children or students might be having some impairment and to prevent them from burdening those children with the current education system. The tool is to be used by children aged 8-12 years. The tool was aimed at predicting whether the child is prone to having an LD with the help of a user friendly interface having many functions. The hope is to make this tool absolutely free to the end users and to also provide the parents with instructions to conduct the test.

In this paper titled "Learning disability prediction tool using ANN and ANFIS" [12], some methods to increase accuracy of the tool and classifier is proposed using soft computing. PCA is used to preprocess data for decreasing the attributes and missing values is filled using a closest fit algorithm. Classes like low, minor or major are also found for concerned children along with predicting whether they have LD and its percentage. MatLab Software is used for this system. The system is able to efficiently measure LD. Missing value computing, attributes reduction methods are used and classification is applied to improve decision's accuracy. ANN

and ANFIS methods used to perform data mining are better than others like J48, Naive Bayes for LD calculation as it is more efficient and accurate.

2.2 Limitations

The Existing Systems involves performing various tests, using algorithms, questionnaires, surveys etc. to detect Learning Disability amongst various age groups. These can be formal or informal tests. However, these systems have many drawbacks:

- The formal testing occurs at specific locations (e.g Nair hospital in Mumbai) which involves taking appointment with no guarantee of getting one. It is a prolonged, tedious procedure with no clarity in terms of the output (whether LD or Not LD).
- The informal systems where questionnaires or surveys are used are static and so are their parameters and properties.
- The set of parameters/attributes considered for learning disability do not provide satisfactory results and not sufficient to conclude anything since lack of knowledge at the student's side which could also result in incorrect or no responses.

2.3 Problem Statement

The main aim of this topic is to perform classification on the students of age group(11-13) into LD or non LD and performing detection to identify whether the student is Dyslexic or not. These students implicitly have some degree of problems with mathematics as well.

2.4 Objectives

- To gather the characteristics or parameters for establishing the features.
- To generate the learning profile in the e-learning platform on the basis of the characteristics.
- To apply Machine Learning Algorithms to detect the corresponding profiles.

CHAPTER 3
PROPOSED SYSTEM

3.1 The System

The proposed system is to create an e-learning system where a user (student) takes a course created on the basis of certain difficulties and their performance i.e. responses and some other parameters such as duration and scores are later extracted and analysis to detect whether they are having LD (Dyslexia in our case) or not. The system aims to overcome the following drawbacks:

- The main drawback as discussed in the previous chapter is that formal testing is no longer feasible and convenient so we have opted for informal testing. This enables us to conduct the test just with the help of a computer and is portable, hence convenient. Also, our aim is to not completely eliminate human intervention such as that of domain experts but to reduce it. The system focuses on being an intermediary between them and the children who attempt these courses.

- Our system enhances the detection aspect of the existing informal system by solving the problems of LD students on the basis of verified difficulty parameters. This helps to make a correct and informed decision for prediction purposes.

- The issue of curriculum bias is solved here by designing the courses on the basis of the difficulties faced by the children, their mental growth, the level of reading, speaking, comprehending etc. according to their

age rather than creating the course as per their curriculum or syllabus.

- The focus has been shifted to the age group (11-13) where the students generally are LD certified in the special schools. This makes sure that the model trained to perform prediction is trained by proper labelled data.

3.2 Components of System

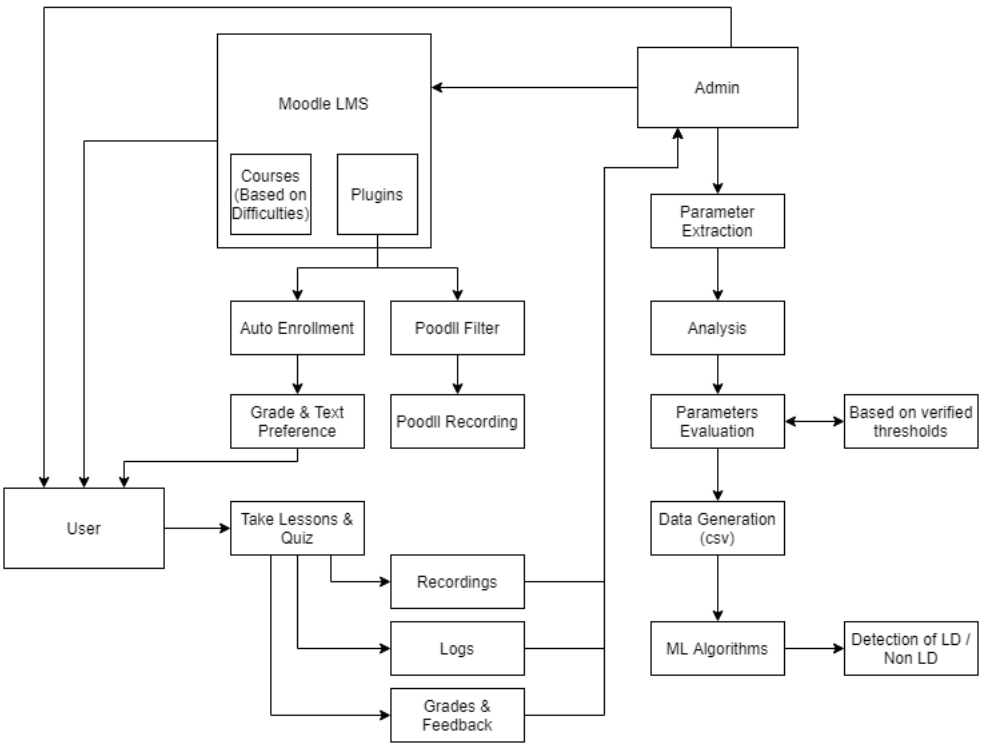


Figure 3.1: Framework of Proposed System

- **User** - The users log on to the system through their dedicated account using the corresponding credentials.
- **Moodle LMS**- This is the entire system that is created as the learning platform. This is mainly divided into two parts:
  1. Courses - The course is designed for the age group of 11-13 years i.e. typically 6-8 grade children. The course is created to detect

whether the student is Dyslexic or not and designed accordingly keeping in mind the difficulties faced by these children. The various types of questions in different quizzes are aimed at certain difficulty/difficulties and when the students attempt these quizzes or answering the questions helps to identify whether they have that particular difficulty/difficulties or not.

2. Plugins - This is the second main part of the Moodle LMS. These are a set of tools that aid to provide certain features which enables the course to perform some tasks which were not possible before. These plugins act upon the courses where they are set. We have used two plugins namely:

   (a) Enrol by user profile fields - This plugin auto enrols the user into a course when the user's profile satisfies certain conditions set for that course.

   (b) Poodll Recording - This plugin has a requirement of another plugin to be installed called 'Poodll Filter'. The Poodll Filter is a base plugin without which this plugin will not work. This plugin enables providing audio, video and sketch responses to the questions of this type in a quiz.

- **Admin** - They are the first user of any Moodle LMS System responsible for creating and managing the whole system. They perform a wide range of tasks. Some of them are:

  1. Create, edit, delete courses in the system and all the activities in it.

  2. Install, set up, manage, uninstall plugins for the various courses.

3. Create, delete users with all their details, profile and set, reset different roles to different users as well such as student, course teacher, manager etc.
4. Access the logs, reports, grades, responses of all the users.
5. Can perform backup, restore operations on courses or even the entire system
6. Check activities in the courses and its topics including the grade sheet and and participants.

- **Data Handling & Analysis** - This group of components deals with fetching all the users data from the Moodle through the Admin user, analysing the data using python which is outside the Moodle environment. The results obtained through analysis using python are evaluated and reevaluated on the basis of verified thresholds. The data generated as a result of thresholding is in the suitable format for creating the dataset.

- **Machine Learning** - ML is applied on the dataset created. ML algorithms are short listed on the basis of the type of output of the dataset. The algorithms classify the output classes and detect whether an unknown sample is LD or not on the basis of the trained model.

CHAPTER 4

DESIGN & METHODOLOGY

4.1 Design

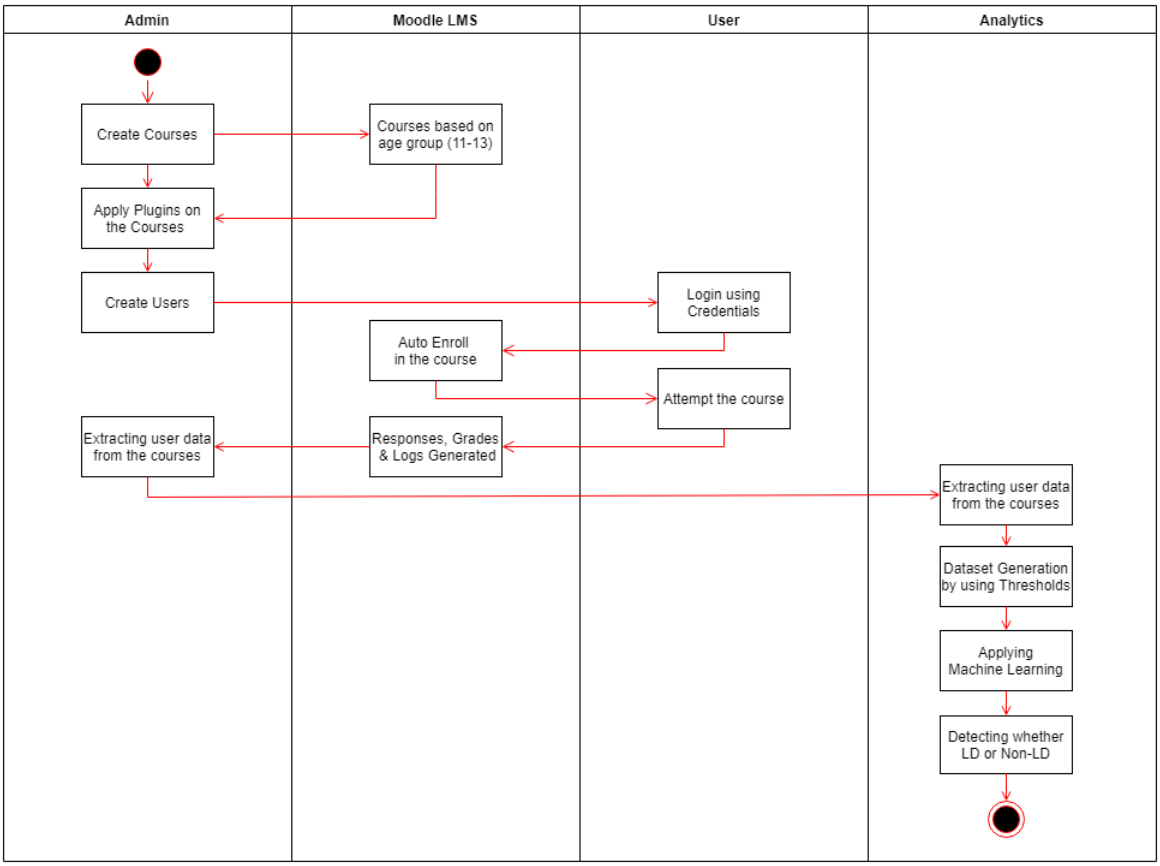


Figure 4.1 : Activity UML diagram

4.2 Methodology

- Create a e-learning system on Moodle LMS
- Create courses for the age groups 11-13 years i.e. for grades 6,7 & 8 through the Admin user considering the difficulties faced by Dyslexic students. Each course (of a particular grade) has an English part with quizzes and activities assessing the reading and comprehension capabilities. There is also a Maths section in each of these courses assessing on the basis of mental or logical capabilities along with issues like being able to perform carry operations.
- Setting up plugins for auto enrollment of users on the basis of the matching preferences, grade from the profile. Plugin for providing audio input to the users.
- Create dedicated user accounts for the students to login and attempt the course.
- Once, the users attempt the course, their data is generated in the form of their responses, grades and logs.
- The data generated is extracted by the admin and is used for analysis purposes.
- The data is then analysed using python language to convert the raw data into meaningful information.
- The aforementioned analysis is performed using a set of verified parameters and corresponding threshold values. The verified parameters are as follows:-

1. Is there a Miscue (Addition, Substitution and Reversal of words) problem.
2. Ability to answer Direct & Indirect Questions in English Comprehension.
3. Ability to describe a picture and a topic in a few sentences.
4. Able to identify Word Relations.
5. Able to solve simple and complex Math problems.
6. Able to perform carry operations.
7. Whether there is presence of short term memory loss.

- These parameters along with durations of the attempts, revisits and question skips form the features of the dataset.
- These features are the difficulties under reading disability and their values are converted to binary using their respective thresholds.
- The resulting dataset is loaded as a CSV (Comma-Separated Values) file into the ML code where detection is performed in python language by using the libraries for Logistic Regression & SVM algorithm.

4.3 Algorithm Implementation

The speeches of the users recorded in Moodle can be downloaded only in MP3 format. So, these recordings have to be converted to WAV format before passing them to the speech recognition part. To convert the recording from one audio format to another, we have used the *pydub* package. From this package we import the *AudioSegment* library which has a

method called *from_mp3()*. The MP3 file to be converted is passed as a parameter to this method. The *export(, format="wav")* function in *AudioSegment.from_mp3()* converts the MP3 file to the WAV format.[13] Also, if the audio recording is done via a Computer application, then there is also a provision for converting M4A audio file to MP3 format so that the resulting MP3 file can be converted to WAV format as mentioned above.[14]
The speech is converted to text using the *SpeechRecognition* package in python. This package has a *Recognizer* class. An instance of this class is used to recognize speech. Each *Recognizer()* instance has seven methods out of which we have used *recognize_google()* for which the default API key for the Google Web Speech API is provided in the *SpeechRecognition* package. Audio file in WAV format is passed as a parameter to the method *recognize_google()* which gives the text output.[15]
The audio file inputs (WAV, MP3 or M4A format) required by the above two segments are taken dynamically i.e. in run-time by using the *tkinter* package. This package has a module called *filedialog* which provides multiple functions for various dialog boxes respectively. Out of the many functions available, we have used *askopenfilename* which creates an Open dialog box and returns the selected filename. This function has been used for loading the required audio file in the script. Another function used is *asksaveasfilename* which creates a SaveAs dialog box and returns the selected filename. This function has been used for saving the audio file post it's format conversion in the script. The files loaded here are used for further analysis in the scripts explained below.[16]
Specific ways of comparing two strings is provided in the *difflib* package. The *difflib.ndiff()* method gives the difference between two words in terms

of the characters needed to be added or subtracted to convert one string to another.[17]

To preprocess the text, we have used the *nltk()* package. There are multiple inbuilt methods available for preprocessing out of which we have used *word_tokenize()* from *nltk.tokenize* which tokenizes (list of words) a string passed as parameter to this method.[18] Another method of this package used is *stopwords* from *nltk.corpus*. In this method, when the parameter *'english'* is passed to the function *stopwords.words()*, a list of stopwords in english language is obtained.[19]

The **miscue analysis** is performed on the speech input of a user, obtained through an assessment in Moodle where they have to read aloud a given passage. To find whether the user has a miscue problem, the following steps are followed:

1. Terms used in Miscue Analysis:
   (a) *original* - list of the words (excluding punctuation) of the actual passage
   (b) *obtained* - list of words of converted text from the speech input of that passage.
   (c) *count* - set for each difficulty to obtain the corresponding no. of mistakes.
   (d) *current* - pointing to the current word in a list.
   (e) *next* - pointing to the next word in a list.
2. Compare both the lists parallelly word by word for identifying mismatches.
3. If *current* of *original* $\neq$ *current* of *obtained*, then

(a) For word substitutions: if *next* of *original* = *next* of *obtained*, then *count* +1, else if, *next* +1 of *original* = *next* +1 of *obtained*, then *count* +2.

(b) For word additions: if *current* of *original* = *next* of *obtained*, then *count* +1, else if, *current* of *original* = *next* +1 of *obtained*, then *count* +2.

(c) For word omissions: if *next* of *original* = *current* of *obtained*, then *count* +1, else if, *next* +1 of *original* = *current* of *obtained*, then *count* +2.

(d) For letter reversals in word: if 'b','m','n','p, in *current* of *original* = 'd','w','u','q' in *current* of *obtained* or vice-versa, then *count* +1.

4. For mispronunciation of a word: Create *words* - a list of unique words in *original*
   $\forall$ *current* in *words*, if $\frac{\text{No. of occurrences of } current \text{ in } obtained}{\text{No. of occurrences of } current \text{ in } original} > 0.3$, then *count* +1.

5. For prefix/suffix addition in a word: if *current* of *original* $\in$ *current* of *obtained*, then if *current* of *obtained* - *current* of *original* $\in$ set of few prefixes/suffixes, then *count* +1. Here *difflib.ndiff()* has been used.

Total Mistakes = words substituted + words added + words omitted + words with letter reversals + mispronounced words + words with prefix/suffix added i.e add all the *count* in steps 3 to 5.

If $Percentage\ of\ Mistakes = \frac{Total\ Mistakes}{\text{Total no. of words in the passage}}$

If *Percentage of Mistakes* > 30%, User has miscue problem. Else, no

miscue problem

Note: For the difficulties such as word substitutions, additions & omissions, the logic is designed with the assumption that any user is less likely to make each of these mistakes more than twice consecutively. The difficulties word additions and omissions have to be computed separately.

The **picture description** is used to analyse the visual and the audio processing skills of the student which is done by providing a picture of a garden and asking them to describe the image in their own words by recording their speech on the system which is later obtained from Moodle. To understand whether the user has the ability to describe the picture well or not we capture 5 recordings each capturing a particular sentence.

Thus have created a corpus or a text file containing 10 possible sentences explaining the picture as accurately and closely as possible and then finding out the similarity between the spoken sentence and the corpus.

We have calculated the similarity by using cosine similarity [22][23] technique, it is a good method for determining semantic similarity between sentences. To determine we perform the following steps they are as follows:

1. Each of the MP3 recordings of the user is given as input as mentioned in the *tkinter()* section and then converted to text as mentioned in the *SpeechRecognition()* section.

2. The string obtained is converted to lowercase using *lower()* and then tokenized and the set of keywords called *X_Set* is created by removing the stop words using *nltk()*

3. Now, we iterate over the corpus sentences which are stored in a text

file. In each iteration, a single sentence is considered, it is converted to lowercase using *lower()* and then, stopwords are removed using *nltk()* and a keywords set is obtained and stored in *Y_Set*.

4. A union of *X_Set* and *Y_Set* called *rvector* is created and two lists *l1* and *l2* are initialized.

5. For each *keyword* in *rvector*: if *keyword* in *X_Set*, then append the value 1 in *l1* else, append 0 in *l1*. Similarly we append the values 1 or 0 in *l2* if present in *Y_Set*.

6. Thus, lists *l1* and *l2* are vectors (0,1) of the same size.

7. Counter *c* is initialized to 0.

8. Now, the cosine formula is used to calculate the similarity between the two vectors i.e. the dot products of the vectors *l1* and *l2* are stored in a variable *c*.

9. Then *c* is divided by the product of square roots of *l1* and *l2* stored in variable *cosine*.

10. This process is repeated such that similarity between the recorded sentence and each sentence in the corpus is obtained from variable *cosine* and is appended in a list called *list1*.

11. Now, we simply check if the maximum percentage value in *list1* is greater than the threshold of 40% then, the recorded sentence is classified as similar to the corpus else, it is classified as not similar.

12. This whole process is repeated for each MP3 recording of the user.

13. If more than 60% (3 out of 5) of the sentences have the cosine similarity of less than 40% with the corpus, then it means that the user has difficulty in describing the picture, else he does not have this difficulty.

The **topic description** mainly helps us understand whether the student is able to frame correct sentences and gauge the understanding of the topic. To find out whether the student has this difficulty or not, we have created an assessment in Moodle where a topic is provided and the students are made to speak 5 sentences on the topic given.

The TXT file or the corpus containing approximately 70 sentences that best describe the topic. A package called *wordcloud* is used to generate the word cloud. We have made use of the method *WordCloud* from the package where *stopwords* removal is performed using *STOPWORDS* method. The file is passed as a parameter to a function in this method called *WordCloud().generate()*.[20][21] The *matplotlib* package is used to visualize the word cloud as further explained in Chapter 5. It also highlights the significant textual data points. Word clouds are widely used for analyzing data from social network websites.

Then we plot the bar graph of words vs frequencies where the top 100 frequent words are plotted as discussed further in Chapter 5

The MP3 recording from Moodle is converted to WAV format and then provided as an input to the program. It is converted to text, lowercased, tokenized and then a set of keywords is obtained. This is compared with a set of keywords obtained from the corpus and both are converted to vectors of equal length and then cosine similarity is calculated to find out the similarity between the 2 vectors. Cosine Similarity [22][23] is the dot product of the 2 vectors divided by the magnitude of the vectors. If the

Cosine Similarity is higher (closer to 1) then similar else, not similar.
This whole process is repeated for each WAV recording of the user. If 3 out of 5 i.e. 60% of the sentences have the cosine similarity closer to 0, then it means that the user has difficulty in describing the topic, else he does not have this difficulty.

The **short term memory loss** is assessed by recording the speech input of the user obtained via the courses attempted on Moodle. To determine whether the user has short term memory loss, we provide an audio recording containing a small passage including sequences of specific objects to be memorized.

We have created a text file containing the sequence of the objects to be spoken by the user in the order in which it appears in the recording.

The users recording is downloaded from the admins profile and then externally analysed with our corpus. The corpus is a text file which is initially opened and read line by line. The text file is opened using file pointer in read mode and a FOR loop is run over the text file to get each line. The converted speech to text is then compared exactly with every line in the text file. Then the spoken text is then compared within FOR loop with each and every line obtained and then string matching is performed i.e. exact string matching is performed between the spoken text and text file (corpus).

If the percentage of *short term memory loss* $< 100\%$ then we can say that the user cannot retain the sequence i.e. the user has short term memory loss otherwise the user does not have *short term memory loss.*

ML algorithms are applied on the dataset which is stored in a dataframe. The dataframe is preprocessed and finally, it is used for building and train-

ing the model using algorithms. Two separate models are built using Logistic Regression and SVM.

Logistic regression is a statistical model that uses a logistic function to model a binary class or multi-class label. It estimates the parameters of a logistic model in binary regression. A binary logistic model (used here) has a dependent variable with two possible classes which is represented by values labeled "0" and "1".[24]

SVM algorithm is used for classification, regression and outliers detection. It is a supervised learning algorithm. This algorithm is effective in high dimensional spaces. It is memory efficient because it uses a subset of training points called support vectors in the decision function. Some disadvantages are that it does not directly provide probability estimates, which have to be computed using a five-fold cross-validation.[25]

4.4 Hardware & Software

- Anaconda Distribution of Python
- Jupyter Notebook
- Moodle LMS & Plugins
- Google Web API for Speech-to-Text
- Google Sheets

Since, our project is majorly software based, we have only had the requirement of microphone as a Hardware.

CHAPTER 5

RESULTS & DISCUSSIONS

5.1 Implementation

```
Abraham Lincoln was born in 1809 in northern Kentucky At the time of his birth Kentucky was part of the
western frontier of the US His father was a farmer and at one point was relatively wealthy However when
young Abraham was only 7 years old his father lost his land The family moved to Indiana where his mother
died when he was 9 When he was a young man Abraham's family moved to Illinois Abraham had little formal
education growing up He loved to read so he educated himself In Illinois he studied law by reading law
books He became a lawyer in 1837 in Springfield Illinois Lincoln's political career began early and he
served in the state legislature and in the US House of Representatives Lincoln was a gifted speaker He won
national attention for his speeches against slavery during several debates This led to his nomination for
the presidency which he won in 1860 President Lincoln's election angered the Southern states and 7 of them
announced they would leave the U.S. and form their own government In 1861 South Carolina troops fired
artillery at Fort Sumter a U.S. military fort This began the Civil War The war would be the central
feature of Lincoln's presidency Lincoln's goal through the war was to reunite the North known as the Union
with the South known as the Confederacy As commander-in-chief he selected the Union generals to lead the
Army He issued the Emancipation Proclamation in 1863 which signaled freedom for the slaves Lincoln was
re-elected in 1864 After 4 long years the Union won the Civil War in April 1865 Lincoln's goal to reunite
the country had come true but he would not live to see it Just 6 days after the end of the war on April 15
1865 President Lincoln was killed by John Wilkes Booth He was the first American president to be
assassinated Abraham Lincoln is considered one of the greatest American presidents He calmly led the
country through the most difficult time in its history the Civil War He is remembered today for his wisdom
his compassion and his patriotism
```

Figure 5.1: Passage Text

A sample of the original passage (without punctuation) used for miscue analysis for grade 7 as shown.

```
Abraham Lincoln was born in 1809 northern Kentucky At time of his birth Kentucky was part of the western frontier of the US His father was farmer and one p
oint was relatively wealthy However when young Abraham was only 7 years old his father lost land The family moved to Indiana where his mother died when he
was 9 When he young man Abraham's family moved to Illinois Abraham had little formal education growing up He loved read so he educated himself In Illinois
he studied law by reading law books He became lawyer in 1837 in Springfield Illinois Lincoln's political career began early and he served in the state legi
slature and US House of Representatives Lincoln was a gifted speaker He won national attention for his speeches against slavery during several debates This
 led to his nomination for the presidency which he won in 1860 President Lincoln's election angered the Southern states and 7 them announced they would lea
ve the U.S. and form their own government In 1861 South Carolina troops fired artillery at Fort Sumter a U.S. military fort This began the Civil War The wa
r would be the central feature of Lincoln's presidency Lincoln's goal through the war was reunite the North known as the Union with the South known as the
Confederacy As commander-in-chief he selected the Union generals to lead the Army He issued the Emancipation Proclamation in 1863 which signaled freedom fo
r the slaves Lincoln was re-elected in 1864 After 4 long years the Union won the Civil War in April 1865 Lincoln's goal to reunite the country had come tru
e but he would not live to see it Just 6 days after the end of the war on April 15 1865 President Lincoln was killed by John Wilkes Booth He was the first
American president to be assassinated Abraham Lincoln is considered one of the greatest American presidents He calmly led the country through the most diff
icult time in its history the Civil War He is remembered today for his wisdom his compassion and patriotism
```

Figure 5.2: Passage Speech-to-Text (Words Omissions)

The *recognize_google()* method gives the output of text converted from the speech in string format as shown for the passage recording with word omissions. This is stored in a variable and used in further analysis.

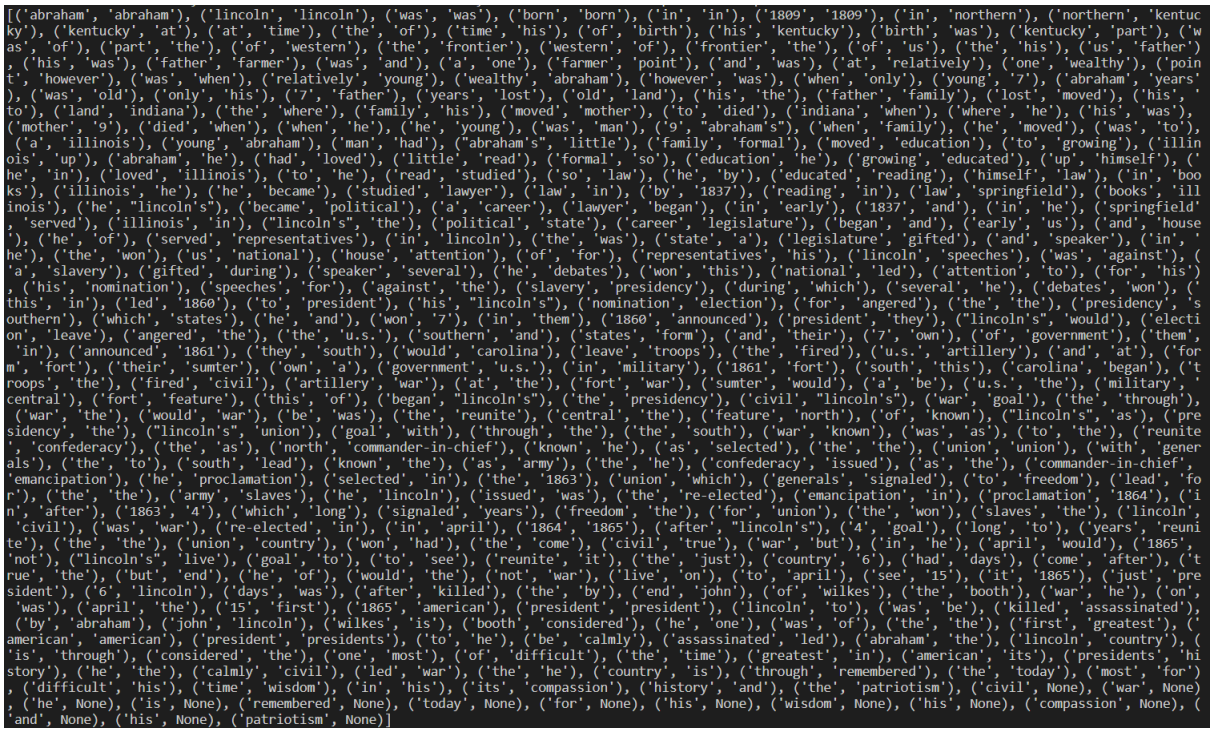


Figure 5.3: Passage List Of Tuples (Words Omissions)

The miscue analysis gives the list of words comparisons in the form of tuples as shown in case of word omissions.

```
Words Omissions: 14
```

Figure 5.4: Passage Words Omissions

The count of mistakes for Word Omissions is shown.

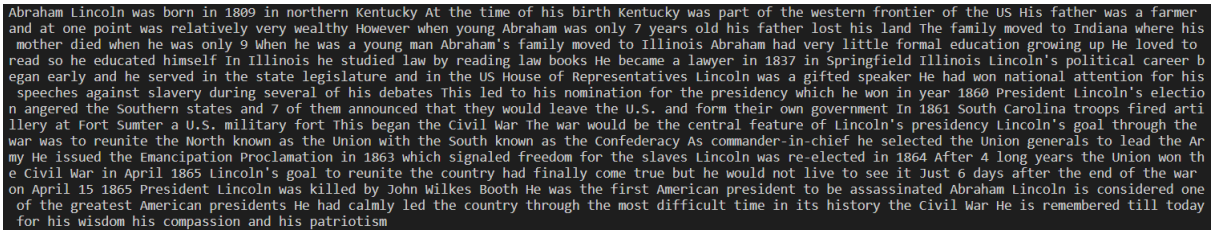


Figure 5.5: Passage Speech-to-Text (Words Additions)

The *recognize_google()* method gives the output of text converted from the speech in string format as shown for the passage recording with word additions. This is stored in a variable and used in further analysis.

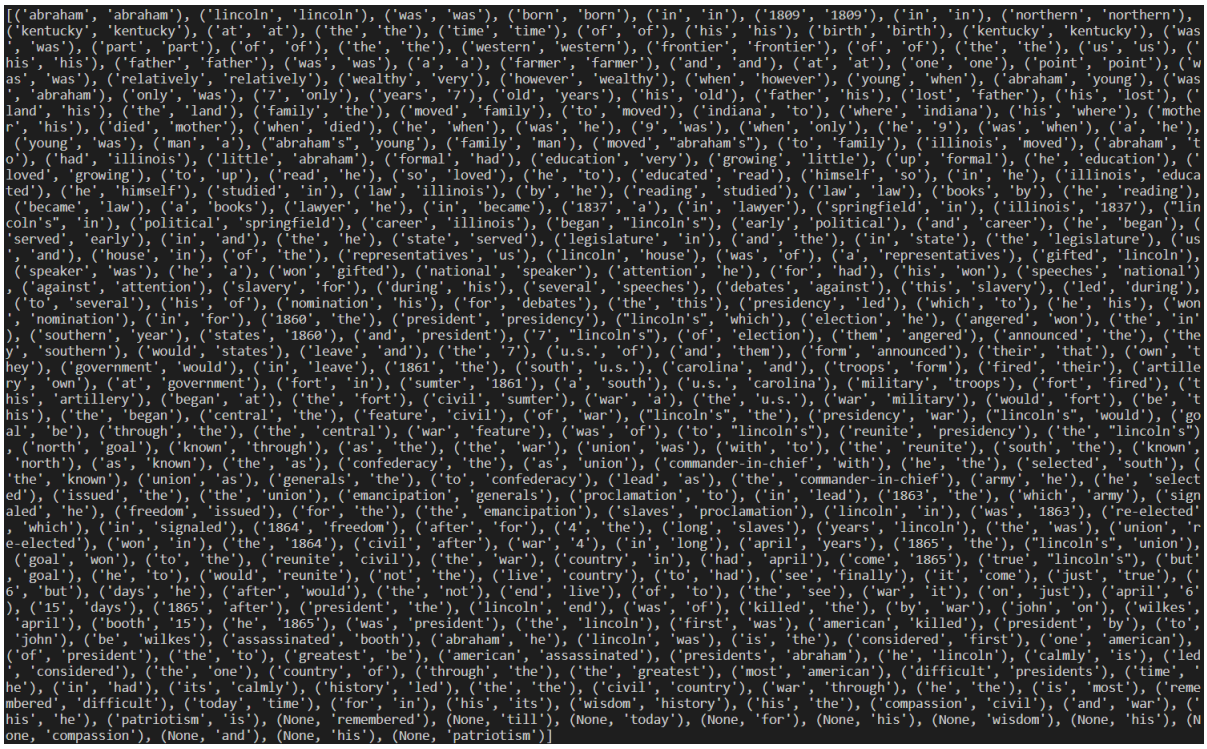


Figure 5.6: Passage List Of Tuples (Words Additions)

The miscue analysis gives the list of words comparisons in the form of tuples as shown in case of word additions.

Figure 5.7: Passage Words Additions

The count of mistakes for Word Additions is shown.

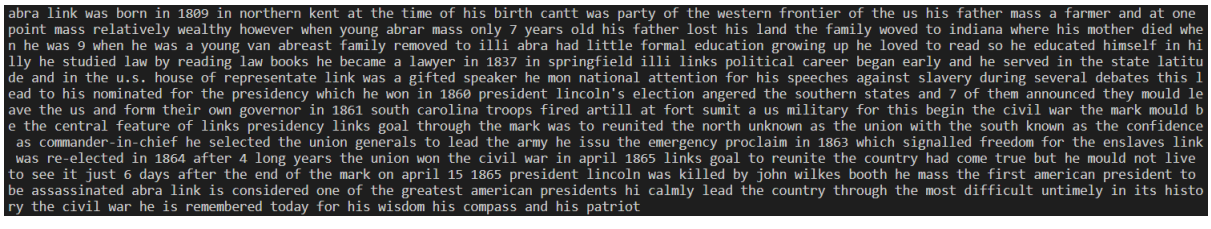


Figure 5.8: Passage Speech-to-Text (Other Miscue)

The *recognize_google()* method gives the output of text converted from the speech in string format as shown for the passage recording with other miscue errors. This is stored in a variable and used in further analysis.

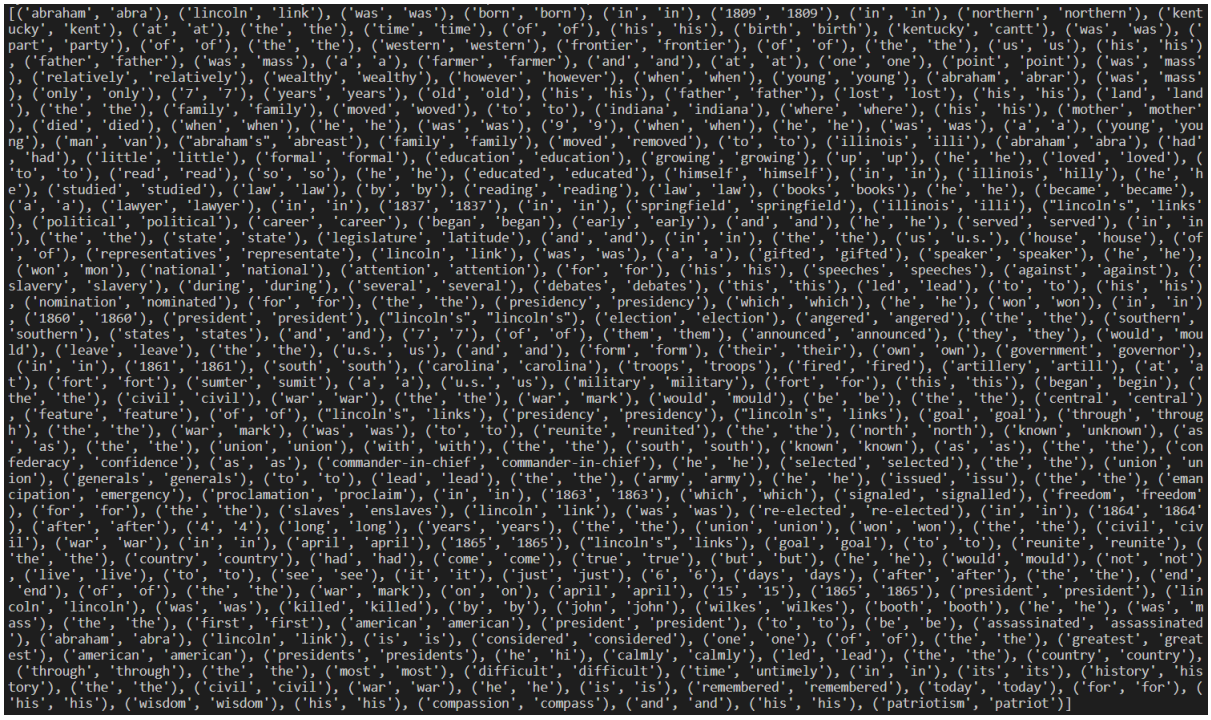


Figure 5.9: Passage List Of Tuples (Other Miscue)

The miscue analysis gives the list of words comparisons in the form of tuples as shown in case of other miscue errors.

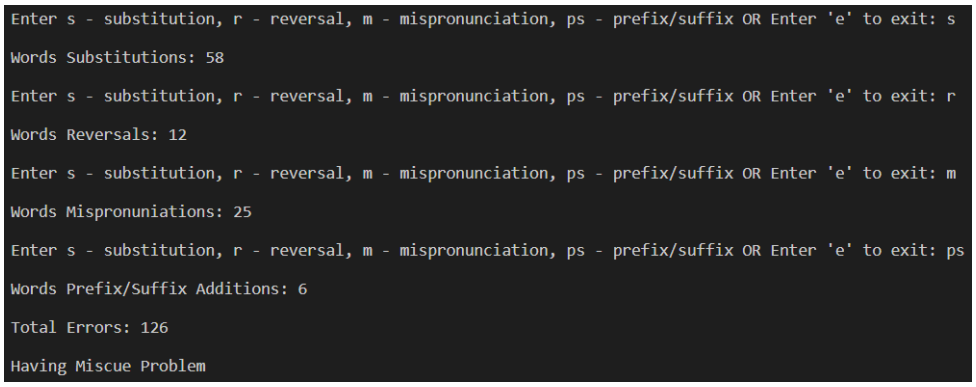


Figure 5.10: Passage Other Miscue

The count of mistakes for Word Substitutions, Reversals, Mispronunciations, Prefix/Suffix Additions is shown. Finally, the output *'Total Errors:'* followed by *'Having Miscue Problem'* or *'Not Having Miscue Problem'* is shown. This output depends on the percentage of mistakes.

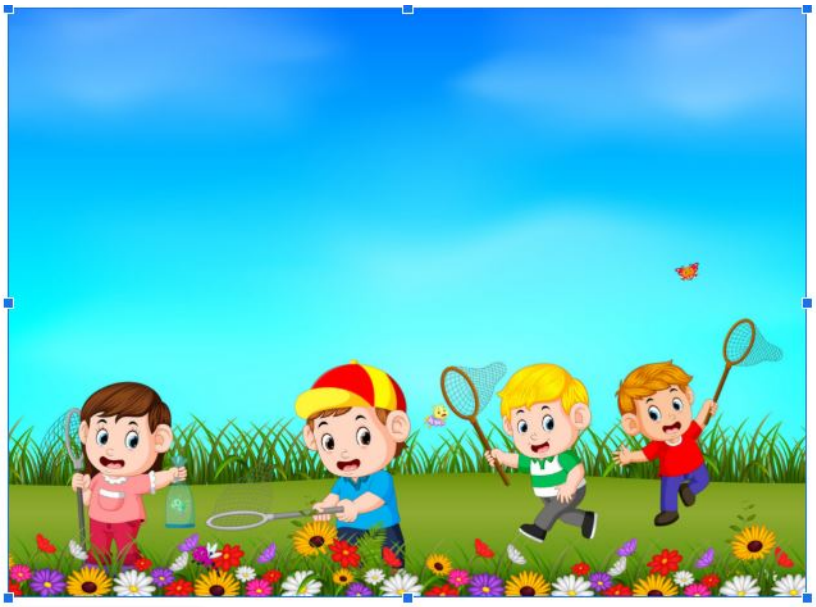


Figure 5.11: Picture of 'Garden'

The sample picture of the 'Garden' for grade 6 is shown.

picture_g6.txt

```
1  There are four children in the garden with colourful flowers
2  There are three boys and one girl playing on green coloured grass
3  The children in the garden are holding nets in their hands to catch some bees
4  The girl has also caught a bee in a cover
5  All the boys going to catch some bees
6  The garden has yellow purple red pink and white coloured flowers
7  There is tall dark green coloured grass behind the children
8  All the children look very happy
9  The sky has shades of dark and light blue colours with faint clouds
10 The boy wearing a yellow and red coloured cap is trying to catch the bee on the flower
```

Figure 5.12: Corpus of 'Garden'

The text file contains 10 sentences without punctuation used for picture description as shown.

```
PS C:\Users\Shweta\Downloads\pyfolder> python test_pic1.py
four children in the garden with colourful flowers around
{'around', 'garden', 'four', 'colourful', 'flowers', 'children'}
Similarity percentage : 91.28709291752769
Sentence is similar
```

Figure 5.13: Similarity Metric

It shows a sentences describing the Fig 5.11. This is followed by the corresponding keywords list extracted. Max similarity percentage of these keywords is also shown and then finally *Sentence is Similar* as shown i.e. describes the picture correctly.

```
PS C:\Users\Shweta\Downloads\pyfolder> python test_pic1.py
the people are dancing
{'people', 'dancing'}
Similarity percentage : 0.0
Sentence is not similar
```

Figure 5.14: Non-Similarity Metric

It shows a sentences describing the Fig 5.11. This is followed by the corresponding keywords list extracted according to the algorithm explained in implementation. Max similarity percentage of these keywords is also shown and then finally *Sentence is Not Similar* as shown i.e. describes the picture correctly.

My Teacher Corpus

I like all my teachers but ma'am is my favourite among all.
She is our class teacher. She takes our attendance daily in the morning.
She teaches us Mathematics.
I love the subject.
I used to dislike Mathematics earlier. But ma'am teaches it in an interesting way. Now
She is the best teacher and is the favourite of most of my classmates too.
She is a very sweet and kind person.
She explains everything in an easy and fun way.
Whenever we are not able to understand anything she patiently teaches it again and again.
She also knows so much news and facts in the world so that she tells us all those current affairs
to improve our general knowledge.
She teaches us good habits and moral values. She is an ideal teacher.
Teaching is a noble profession and a good teacher is always a gift of God upon us.
All teachers of my school are very good but my favorite teacher is sir
Sir is our class teacher and he teaches us English and Social studies.
Sir is very kind, lovely and he always smiles.
Sir teaches us very kindly. He makes difficult things very easy to understand.
Due to his lovely teaching style the students of his subjects are very bright and intelligent.
Sir has won many good teaching awards in our school and he is liked by all.
Due to his lovely teaching style no one misses his class.
Sir always inspires us and he makes us to do something good in our life.
We always feel blessed by God on having a lovely teacher like sir.
Teachers are the ones who plant the seeds of knowledge sprinkle them and patiently nurtures
their growth to produce tomorrow's dreams
My favorite teacher is name. She is teaching subject.
I like my teacher very much because she is friendly and caring towards everyone.
Her class and subject have become my favorite subject. I love studying
History,Mathematics,English,Geography.
She is the best teacher in the school and is liked by all of my friends.
She is a helpful person and supports weak students
A teacher is an important person in everyone's life.
She brings good education and lays the foundation for good habits.
For students a teacher is the one who influences their character, habits, career, and education
in life.

Figure 5.15: 'My teacher' Corpus

A sample of a few sentences describing the topic 'My Teacher' for grade 6 is shown.

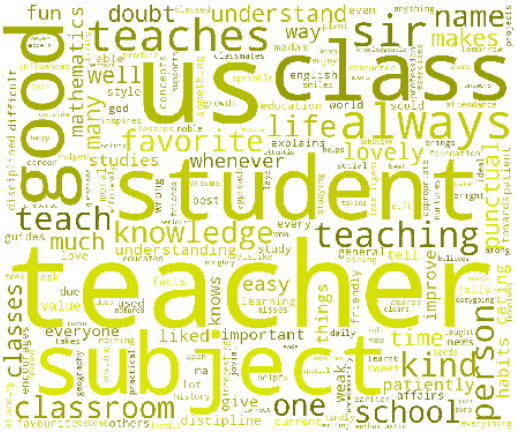


Figure 5.16: Generation of Word Cloud for 'My teacher'

The word cloud for 'My teacher' representing the text data such that the size of each word indicates its frequency or importance as shown.

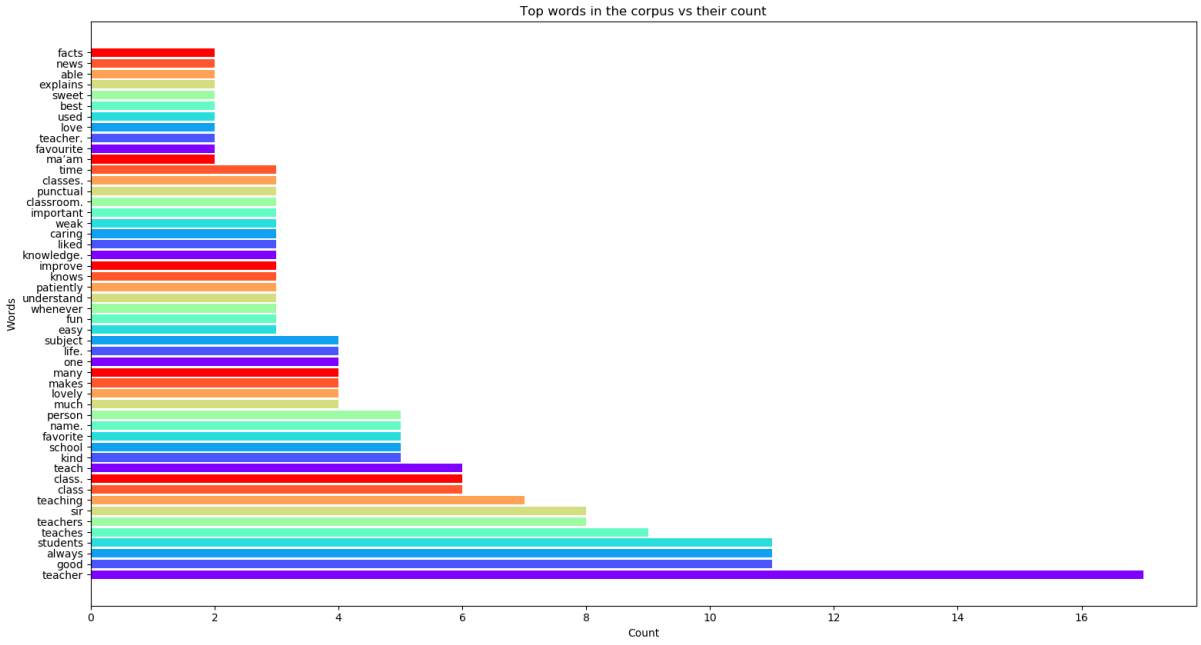


Figure 5.17: Bar graph of Top 50 Features

The bar graph shows the top 50 frequent words and their count on Y axis and X axis respectively.

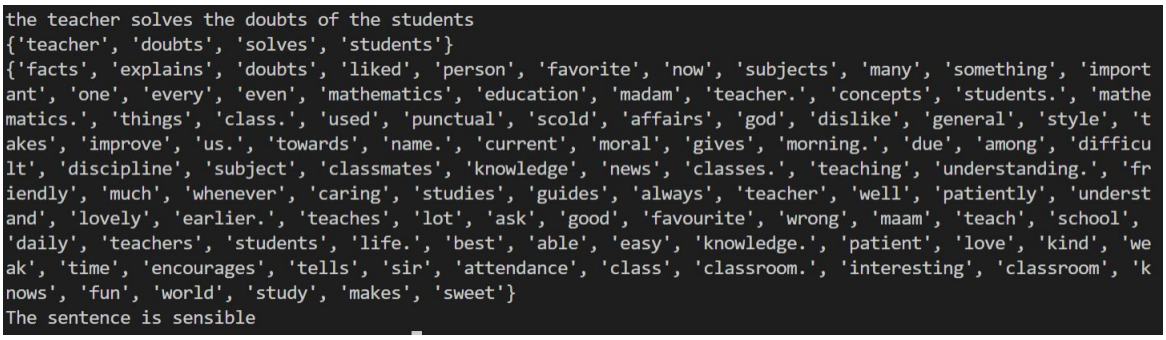


Figure 5.18: Semantically sensible sentence

It shows a sentence describing the topic 'My teacher'. This is followed by the corresponding keywords list extracted. Also, the keywords list of the corpus is shown here and then finally *The Sentence is sensible* i.e. describes the topic accurately.

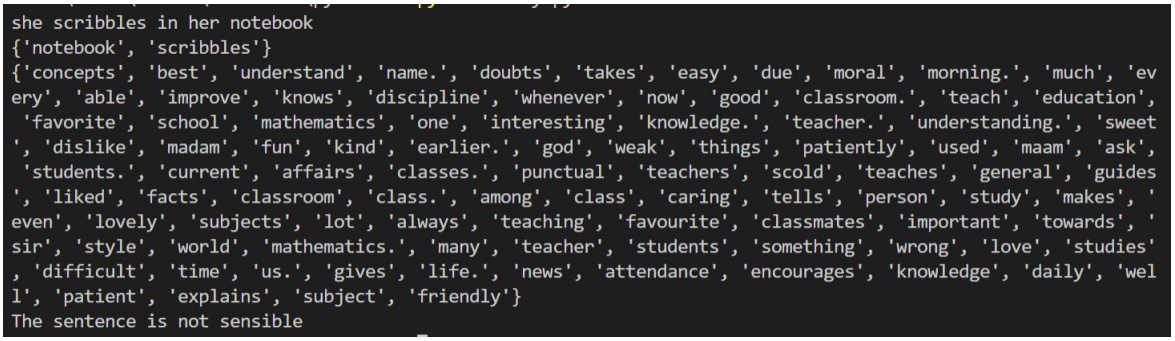


Figure 5.19: Semantically not-sensible sentence

It shows a sentence describing the topic 'My teacher'. This is followed by the corresponding keywords list extracted. Also, the keywords list of the corpus is shown here and then finally *The Sentence is not sensible* i.e. does not describe the topic accurately.

```
green yellow red blue orange,100%
saturday,tuesday,sunday,friday,wednesday,100%
1765,1770,1772,1773,1774,100%
```

Figure 5.20: Corpus for Short Term Memory Loss

This text file contains the correct sequences of the objects i.e. colors (for grade 6), weeks (for grade 7) and years (for grade 8). This is used to evaluate the response of the user.

```
PS C:\Users\Shweta\Downloads\pyfolder> python sequence1.py
green yellow red blue orange
Line Number =  1  :: Line with accuracy =  green yellow red blue orange,100%
```

Figure 5.21: Short Term Memory Loss Sequence(1)

Here, it is shown that the sequence spoken by the user is 100% accurate after matching with the corpus sentence i.e. the user does not have a short term memory loss.

```
PS C:\Users\Shweta\Desktop> python sequence1.py
green yellow red orange blue
Accuracy is 0%
```

Figure 5.22: Short Term Memory Loss Sequence(2)

Here, it is shown that the sequence spoken by the user is 0% accurate after matching with the corpus sentence. The user cannot retain the sequence in memory i.e. there is short term memory loss.

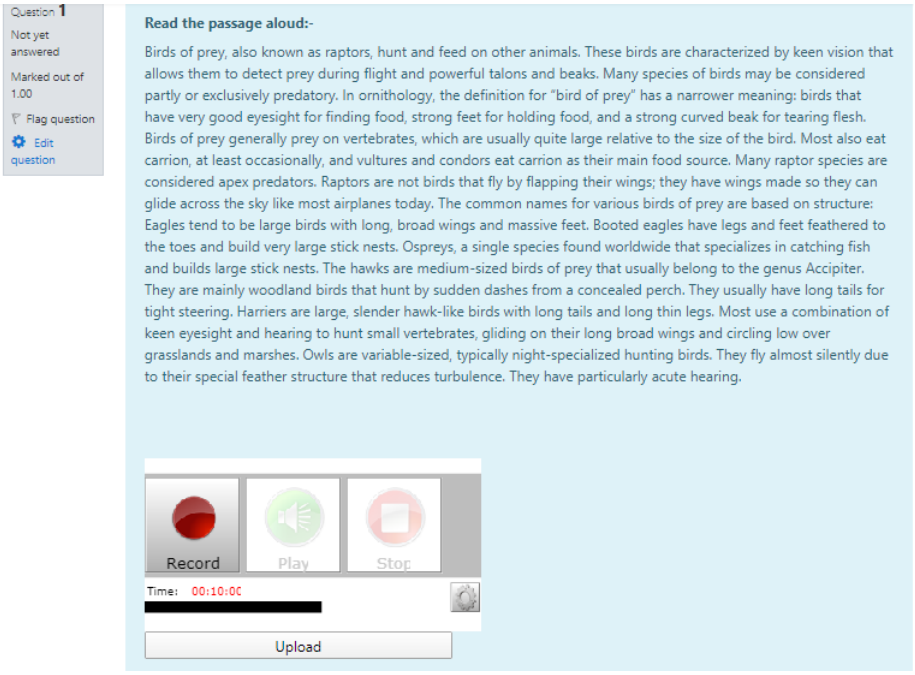


Figure 5.23: Passage Recording

The above figure shows the given passage. Below the passage the student can read the passage aloud and record his voice.

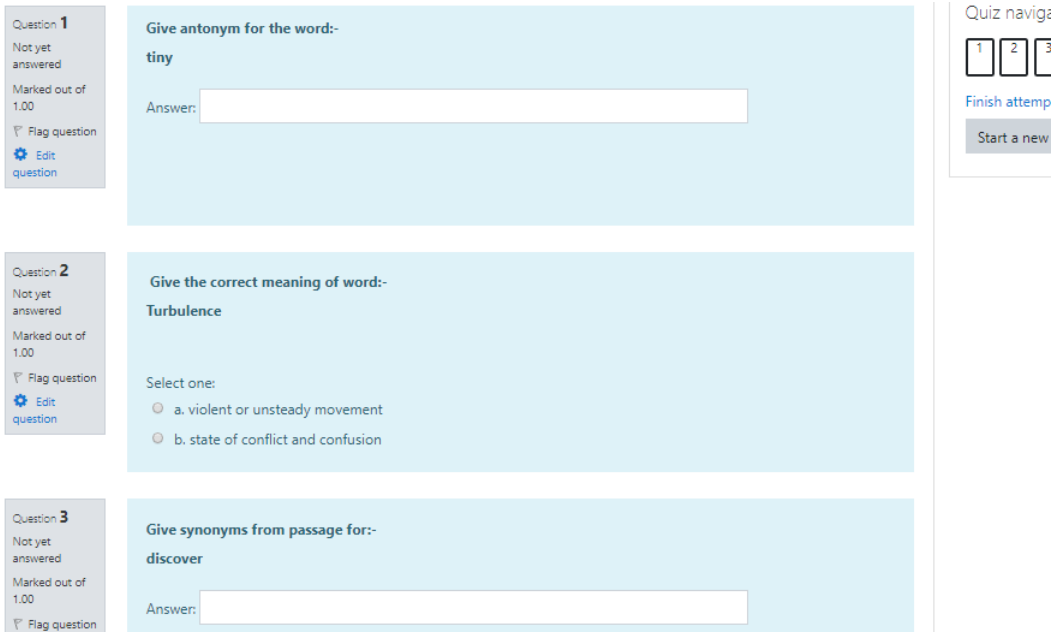


Figure 5.24: Passage Quiz

These are some of the direct and indirect questions asked related to the passage in Figure 5.23.

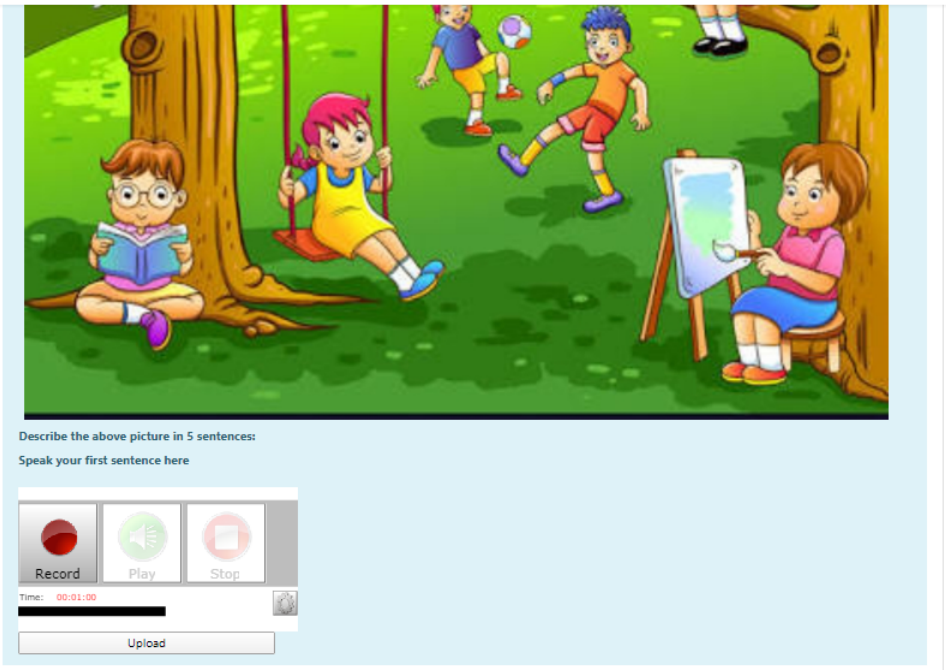


Figure 5.25: Picture Description

The above figure contains a picture for grade 8 and the student has to record 5 sentences describing the picture, one instance is shown here.

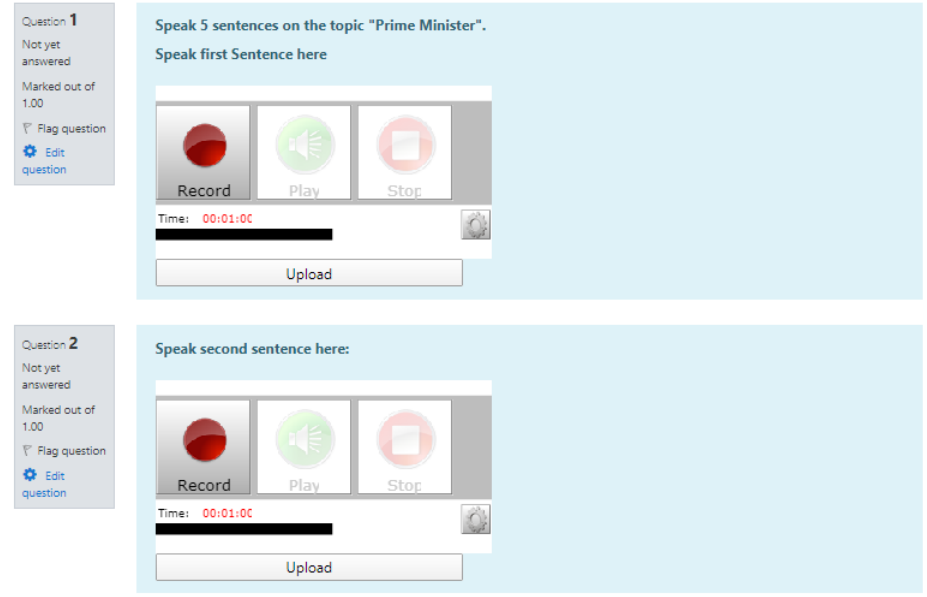


Figure 5.26: Topic Description

The above figure student has to record some sentences describing the topic 'Prime Minister' for grade 8. Total 5 such sentences are recorded.

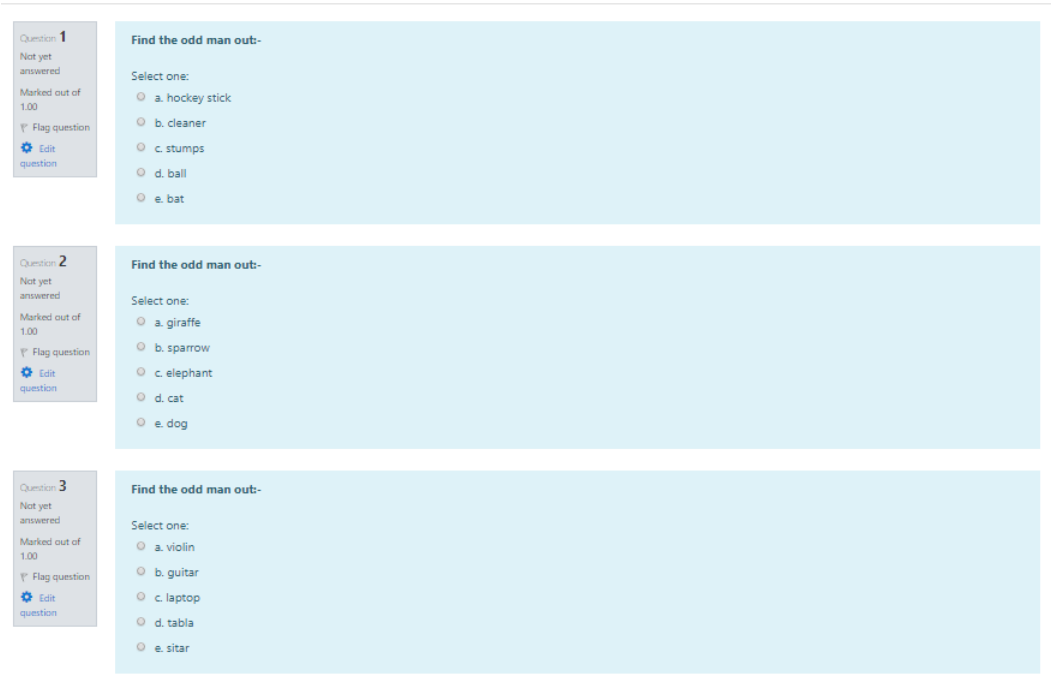


Figure 5.27: Capturing Word Relations

Here, in each question the student has to choose the odd one out. This determines that how much a student understands word relation.

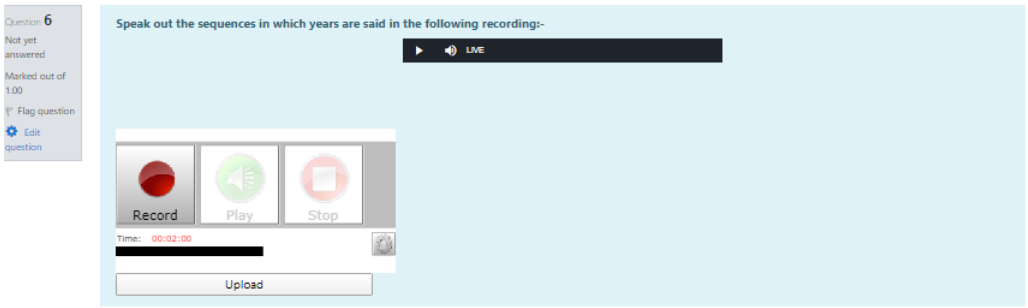


Figure 5.28: Capturing Short Term Memory Loss

Here, we have provided an audio recording of a short passage and the user is expected to remember and speak the desired objects (in this case years) occurring in the passage in the same sequence.

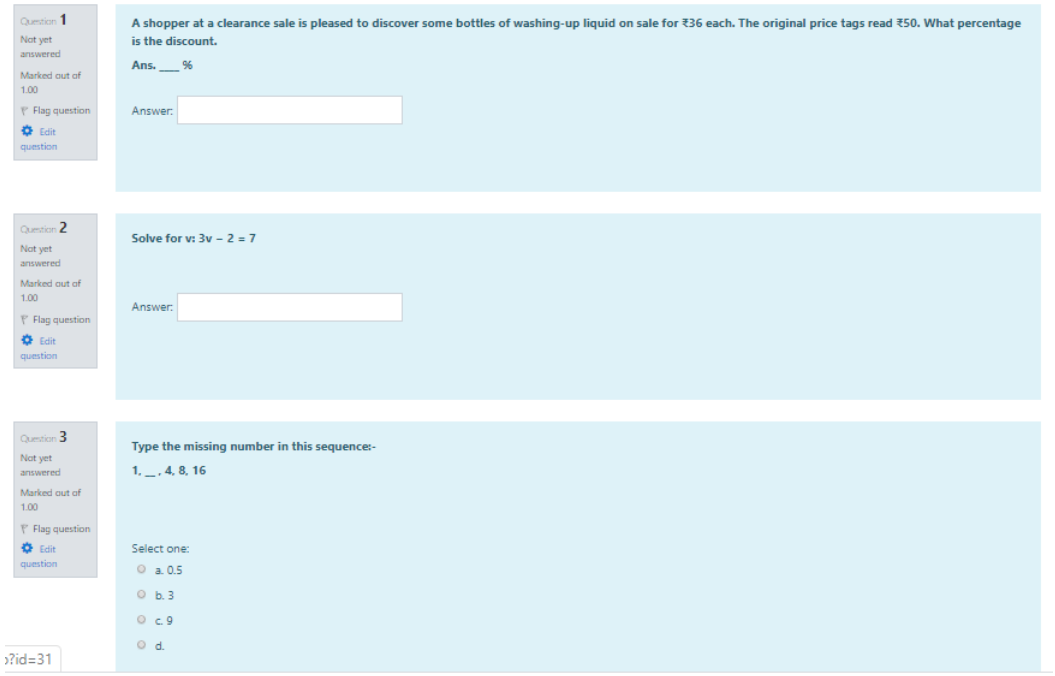


Figure 5.29: Maths Quiz

These are some sample mathematics questions for grade 8 testing their mathematical capabilities.

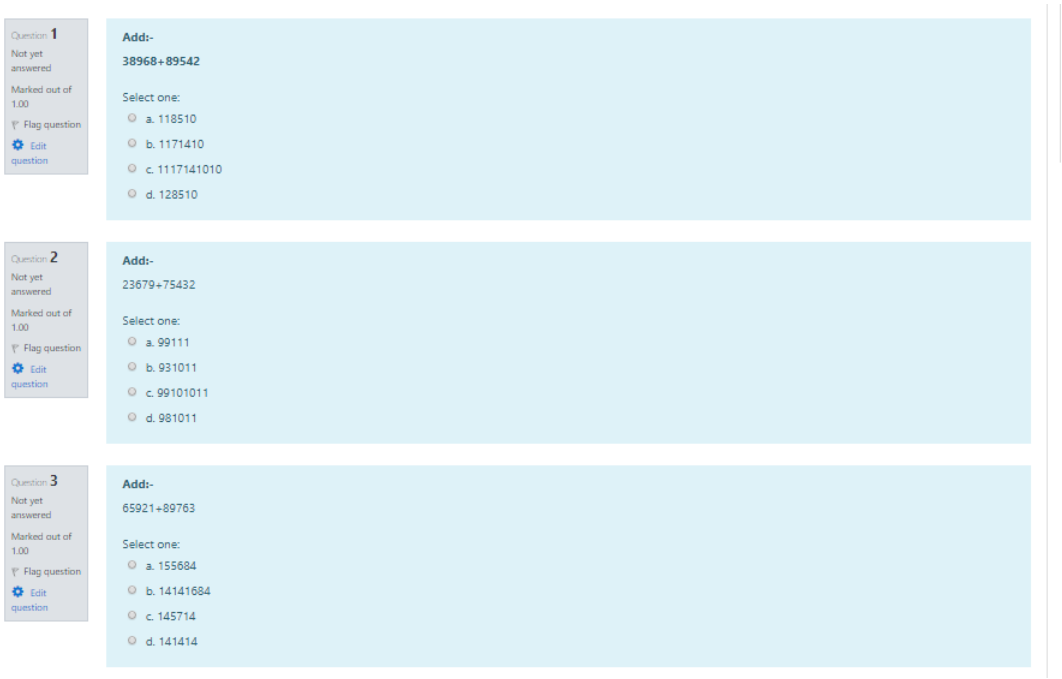


Figure 5.30: Carry Operations Quiz

These question tests whether the student considers carry while performing the operations.

```
1 import pandas as pd
2 import numpy as np
3 df = pd.read_csv(r'BE Project Dataset v2.csv')
4 print(df.head(5))
```

```
    User  q_skip  revisits  pass1_dur  pass2_dur  quiz1_dur  quiz2_dur  \
0  g6_u1       4         2       2.16       3.55          1          1
1  g6_u2       7         5       2.21       1.44          2          1
2  g6_u3       4         1       4.34       4.52          4          2
3  g6_u4       5         2       4.42       5.33          3          3
4  g6_u5       1         2       4.55       3.36          4          3

   mathquiz_dur  unabl_pass_dir_q  unabl_pass_indir_q  unabl_des_pic  \
0             4                 0                   1              1
1             1                 0                   0              1
2             2                 1                   1              1
3             4                 0                   0              1
4             7                 1                   1              0

   unabl_des_topic  unabl_id_rel_words  unabl_sol_sim_math  \
0                1                   1                   1
1                1                   1                   1
2                0                   1                   0
3                1                   1                   0
4                1                   0                   1

   unabl_sol_com_math  unabl_per_car  sh_te_mem_lo  is_mis_prob  o/p_class
0                   1              1             1            1          1
1                   1              1             1            1          1
2                   1              1             1            0          1
3                   1              1             1            1          1
4                   1              1             1            1          1
```

Figure 5.31: Dataset Showing all the Parameters

/

```
from sklearn.model_selection import train_test_split

print(df.isnull().sum())

x = df.drop(['User','o/p_class'], axis=1)
y = df['o/p_class']
x_train, x_test, y_train, y_test = train_test_split(x, y, test_size=0.20, random_state=0)
```

```
User                0
q_skip              0
revisits            0
pass1_dur           0
pass2_dur           0
quiz1_dur           0
quiz2_dur           0
mathquiz_dur        0
unabl_pass_dir_q    0
unabl_pass_indir_q  0
unabl_des_pic       0
unabl_des_topic     0
unabl_id_rel_words  0
unabl_sol_sim_math  0
unabl_sol_com_math  0
unabl_per_car       0
sh_te_mem_lo        0
is_mis_prob         0
o/p_class           0
dtype: int64
```

Figure 5.32: Preprocessing the Dataframe

Here, the dataframe is preprocessed by checking for null values and formatting the data i.e. train-test split in 80:20 ratio and segregating output label.

```
from sklearn.linear_model import LogisticRegression

lr = LogisticRegression()
lr.fit(x_train, y_train)
predictions = lr.predict(x_test)
```

Figure 5.33: Logistic Regression Model

Building Logistic Regression Model, fitting it on the train-test split and generating predictions.

```
from sklearn.svm import SVC
svclassifier = SVC(kernel='linear')
svclassifier.fit(x_train, y_train)
y_pred = svclassifier.predict(x_test)
```

Figure 5.34: SVM Model

Building SVM Model, fitting it on the train-test split and generating predictions.

5.2 Testing

```
t1 = [[7,5,4.23,5.12,6,4,3,0,1,1,1,1,0,0,0,1,1]]
print("Class Prediction of unknown tuple 't1':",end=" ")
print(lr.predict(t1))
t2 = [[1,2,1.38,2.34,3.2,2.4,1.5,0,1,0,0,0,0,0,0,1,0]]
print("Class Prediction of unknown tuple 't2':",end=" ")
print(lr.predict(t2))
```

```
Class Prediction of unknown tuple 't1': [1]
Class Prediction of unknown tuple 't2': [0]
```

Figure 5.35: Test Tuples

Figure 5.35 shows the prediction of unknown tuples to be classified as LD(class '1') or non LD(class '0') by the trained model.

5.3 Results & Analysis

```
from sklearn.metrics import classification_report
from sklearn.metrics import confusion_matrix,accuracy_score

print("Classification Report:\n")
print(classification_report(y_test, predictions))
print("Confusion Matrix:")
print(confusion_matrix(y_test, predictions))
print("\nAccuracy:",end=" ")
print(accuracy_score(y_test, predictions))
```

```
Classification Report:

             precision    recall  f1-score   support

          0       0.83      1.00      0.91         5
          1       1.00      0.80      0.89         5

avg / total       0.92      0.90      0.90        10

Confusion Matrix:
[[5 0]
 [1 4]]

Accuracy: 0.9
```

Figure 5.36: Logistic Regression Model Evaluation

```
print("Classification Report:\n")
print(classification_report(y_test,y_pred))
print("Confusion Matrix:")
print(confusion_matrix(y_test,y_pred))
print("\nAccuracy:",end=" ")
print(accuracy_score(y_test, y_pred))
```

```
Classification Report:

             precision    recall  f1-score   support

          0       1.00      1.00      1.00         5
          1       1.00      1.00      1.00         5

avg / total       1.00      1.00      1.00        10

Confusion Matrix:
[[5 0]
 [0 5]]

Accuracy: 1.0
```

Figure 5.37: SVM Model Evaluation

The above Figure 5.36 and Figure 5.37 show the comparative analysis between the ML algorithms called Logistic Regression and SVM respectively. The Evaluation Metrics used here are:

- Precision (Specificity): TP / (TP + FP)
- Recall (Sensitivity): TP / (TP + FN)
- F1 Score: 2 * (Recall * Precision) / (Recall + Precision)
- Support: No. of tuples belonging to the corresponding Class
- Accuracy: (TP + TN) / (TP + FP + FN + TN)

On comparing both the models, it is evident that the SVM Model has superior values for these metrics as compared to the Logistic Regression Model but, the values achieved by the SVM model are theoretically ideal values i.e. all the values are 1.00. This means that model has an accuracy of 100% which is not practically achievable and acceptable. This signifies

that the SVM model is an **over-fitted** model. Therefore, the Logistic Regression model is preferred or chosen over SVM model. The Classification Report of the aforementioned finalized model is as follows:

- The **Accuracy** of this model is 0.9. This tells that our model gives 90% correct predictions which is acceptable and pretty good for an ML classifier.
- High **Precision** corresponds to the low FP rate and we have a good average precision value of 0.92.
- **Recall value** of above 0.5 is considered good and in our case the value is 0.9 which is superior.
- **F1 Score** is the average of Precision and Recall and is usually more helpful than accuracy, especially if you have an uneven class distribution and our average F1 Score is 0.9 which is a good score.
- The **Confusion matrix** tells that there are five TPs which means that five tuples are actually classified into class '1' i.e. LD and are also predicted as belonging to the same class. There are zero FPs which means that no tuples that are actually classified into class '0' i.e. Non-LD are predicted wrongly as belonging to class '1'. There is only one FNs which means that one tuple is actually classified into class '1' but predicted wrongly as belonging to class '0'. There are four TNs which means that four tuples are actually classified into class '0' and are also predicted as belonging to the same class.

CHAPTER 6
CONCLUSION & FUTURE SCOPE

6.1 Conclusion

On the basis of the work done so far we can conclude that the students in between the age group (11-13) having Learning Disability can be solved by conducting the informal testing on the E-learning platform called Moodle. It is a hassle free, simplified process as it saves the time and money spent on formal testing done in specific hospitals. The courses have been structured so as to capture each and every difficulty. The parameters i.e the difficulties faced by a Dyslexic students are verified by special educators. Thus, resulting in a correct method for detection using ML algorithm (logistic regression) and providing an aid to rectify the problems faced by an LD student. So, if any unknown student has to be classified as LD (i.e. Dyslexic in our case) or Non-LD, their characteristics is mapped with the trained model and predicted as Dyslexic or not.

6.2 Future Scope

The system can be further expanded to capture the written responses of the LD students as many of them have low self esteem because of which they do not have the confidence to express themselves freely or properly via speech. The system can also incorporate detecting other disabilities like Dysgraphia, Dyscalculia etc. along with Dyslexia which it is already detecting. Thus, to be able to provide e-learning assistance for holistic schools having students with various learning disabilities such as Dyscalcu-

lia (arithmetic difficulty) and Dysgraphia (pictorial difficulty). The scope can also be increased to be able to dynamically provide a personalized e-learning course which learns based on the user's performance and updates itself to improvise their learning capabilities and capacity which otherwise becomes difficult to capture and quite often goes unnoticed.

We have also proposed adaptivity by suggesting solutions for some of the difficulties faced by Dyslexic students which can be incorporated in the future as shown in Figure 6.1, Figure 6.2 and Figure 6.3.

<table>
<tr><th>Difficulty</th><th>Proposed Solution</th></tr>
<tr><td>Spelling mistakes</td><td>We will provide a grid in which we will break down the word and write each part of the word in the box.The most important thing is that we will also include the trickiest part of the word which is difficult to pronounce in the box.
SMART Spelling Grid
Say Meaning Analyse Remember Teach
<table><tr><td>Say the Word
Write the Word</td><td colspan="8">Break the word up</td><td>Tricky Parts</td></tr><tr><td>bridge</td><td>b</td><td>r</td><td>i</td><td>dge</td><td></td><td></td><td></td><td></td><td>dge</td></tr><tr><td>nudge</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>wedge</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>Then comparing the parts of the word (including the tricky parts) with their corresponding phonetic transcription. Once the child is able to understand how to interpret the phonetic transcriptions, he/she can understand and overcome their spelling mistakes.
For e.g. syllable - /ˈsɪləb(ə)l/</td></tr>
<tr><td>Mispronunciation</td><td>Highlight the word, breaking it into syllables and reading again by adding stress to sounds.
 

For e.g: performance
Syllable: per-for-mans (the way to pronounce).</td></tr>
</table>

Figure 6.1: Adaptivity for wrong spellings, mispronunciation

Difficulty	Proposed Solution
Reversal	We will write the mirror image of the word so that it is shown in the correct way. For e.g. **blod||bold**
Carry problem	We will provide a grid in which in each box there will be a digit.The LD student will perform the addition digit by digit. Box is provided such that he can't write a double digit answer in a single box and thus he has to write the carry (if generated) on top.

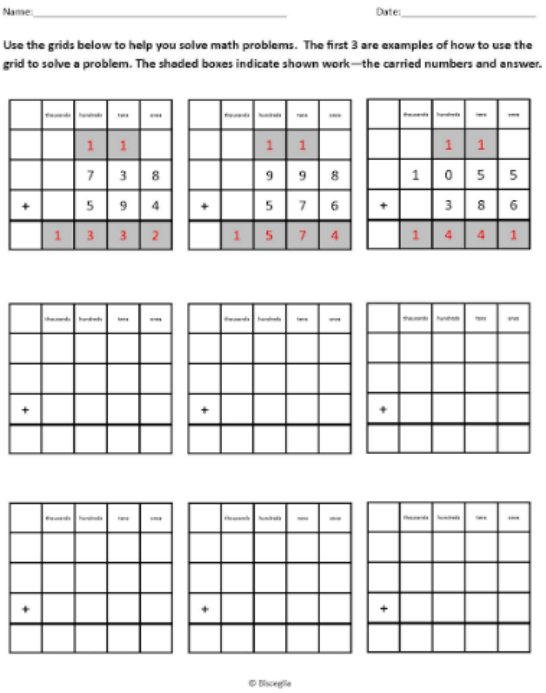


Figure 6.2: Adaptivity for reversal, carry problem

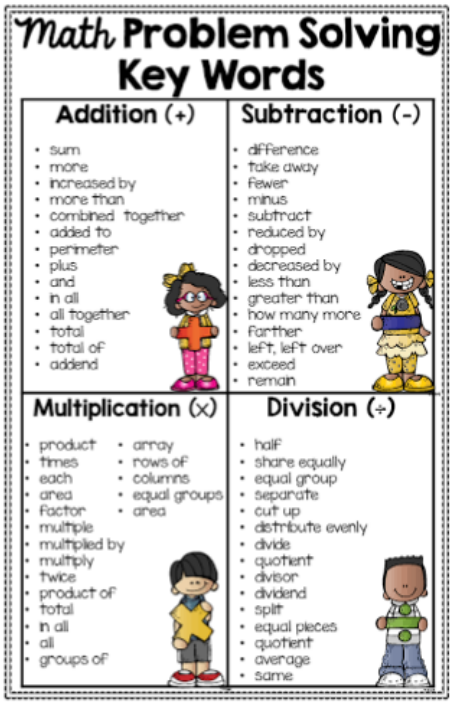
Difficulty	Proposed Solution
Word problem in Math	We will maintain a list of keywords and make the child having LD relate the operation with its corresponding keyword so that he can form patterns that will enable him/her to perform the correct operation when he encounters the keyword in the word problem i.e he/she is able to interpret the mathematical language. 
Short term memory	If the child is not able to memorize the sequences then will repeat those sequences again.

Figure 6.3: Adaptivity for math, short term memory

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Publications

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Submitted: 6/19/2020 8:59:00 AM
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