**Project description**

Question paper marking has always been an intensive process which requires a lot of time and effort. The marking process is also prone to errors when done by humans. Other than that finding information for subject related doubts also time consuming, most of the time retrieved information are advance for student’s age.

The software produced through this research is an Automated structure, diagram question marking and doubt clarification system(ASDQMDCS) which will be a web-based solution where the main goal of this system is to mark the students’ answers to questions set by teachers. There can be two kinds of questions, and they are short structured questions and diagram-type questions. Apart from marking answers to questions set by the teacher, this product also provides a Learning Functionality where the student can enter their own question and the system will provide related information to the student’s doubts. Users will have separate logins. The teachers are provided with the capability of setting questions and answers along with the mark allocation details before the student sits for the examination. After the exam is set, students can login, answer the examination. This system gives feedbacks for each and every question separately. Therefore, the main users of this system are teachers and students. These features are developed as a plugin, will be created for the Learning Management System:

**Uniqueness**

In ASDQMDCS, answers provided by the student will be saved, and it will be compared with the teacher’s answer to allocate marks and give feedback to the answers provided by the student. Structured questions will be marked by analyzing text while different approaches will be used to mark the three different kinds of diagrams, depending on the text, shapes, sequence, and structures required in each diagram. When it comes to the Learning Functionality offered by this system where the student can enter their own question, the system will provide information based on the reference books for the grade of that particular child, which must be added by teachers to the system in pdf format.

Using our question marking module, teachers can easily mark question papers. It saves the time and effort of the teachers. Students can get fair marks with few marking errors by using this system for grading because teachers does not need to mark answers in stressful mind.

Students can improve their knowledge by viewing feedbacks and the marks obtained to that question. Using doubt clarification feature, students can clarify their doubts within a short time period, and it gives answers according to the student’s knowledge.

There are systems already existing to mark answers to Multiple Choice Questions, and to mark other simple questions like “Name two fruits”. Most of the existing systems can not mark answers which compose of sentences provided to answer the questions that asks the students to “Describe, Explain, Justify” by checking the keywords and the meaning of the answer provided by the student, and also most systems do not support marking block diagrams and logic circuits drawn by students. There are no existing systems to answer student’s doubts according to students age. PowerAqua is a one of the similar system for doubt clarifying, but it displays the web answer for user’s questions. Sometimes it displays improper answers. Currently, moodle has only limited question types (MCQ, filling the blanks, etc). Doubt Clarification plugin for moodle will also be developed.

**Features**

ASDQMDCS is a web-based solution designed to make an easier life for teachers by automating the marking process of MCQ, Structured and two Diagram-type questions: Block Diagrams, Logic Circuits. The Doubt Clarification feature provided by this system is intended for students to clarify the subject-related doubts they come across while studying.

Structured Question Marking – Structured Question Answers which have less than five lines are marked by the system by comparing the meaning of the answers provided by students against teacher’s answer.

Diagram Question Marking – Block diagrams which have a fixed flow with start and end blocks at the beginning and end of the diagram are marked by comparing and checking the structural similarity between the teacher’s answer diagram and the student’s answer diagram. Two Blocks are matched by checking their text similarity. Logic Circuits which have a maximum of three labelled inputs and one output with maximum three inputs to all gates except for NOT gate which can have only one input, are marked by comparing and checking the structural similarity between the answer diagrams provided by the teacher and the student for an exact match, and if the teacher chooses to allow other alternative correct answers other than the answer provided by the teacher to be marked correct, simulation is used by the system to mark the answer if a structural similarity exact match is not found.

Doubt Clarification Feature – Students can input their doubt or question to the system in direct words, and this feature retrieves information related to the question asked by the student from well-formatted PDF references added to the system by teachers as per the grade of the student and as per the subject that particular question belongs to. The student must select the subject when entering the question. When adding PDF references, teachers must add the important chapters along with their beginning and ending page numbers.

Moodle Plugins – Moodle does not currently have a plugin which provides students with the capability of clarifying their doubts. In addition to the web-based solution, a moodle plugin will be created for the doubt clarification feature.

**Application of Technology**

PHP, Javascript are the languages used for frontend development while Spring Boot, Java, Flask, Python are used in the backend development.

GoJS diagramming pack is used under evaluation license for the development of the Drag-and-Drop Canvas provided for teachers and students to enter their Block and Logic Circuit Diagram answers.

MySQL, Neo4j are the databases used. MySQL stores all the system-related data while Neo4j is used for the graph construction, graph data retrieval, and easy traversal in Diagram Marking for graph matching.

Libraries:

Stanford Core NLP - The final score for a structured answer of a student is dependent on several calculations: Length-difference or the length-gap which gives an overview of the difference between the lengths of the answer provided by the teacher and the student, Overlap Ratio which measures the frequency of occurrence of a word, Semantic Similarity Score which gives a score based on the already defined relationships in the WordNet Lexical database, and Keyword identification by searching for an exact match using Cosine Similarity.

NLTK - Used in Doubt Clarification to tokenize, remove stop words when retrieving topics from table of contents. It is used in Block Diagram Marking to check text similarity using WordNet path similarity which gives a measure of the relationship between words in WordNet.

PdfMiner - Used to retrieve information from improperly-formatted PDF references.

pdfx v1.9 - Used to convert a PDF to an XML for easy extraction of data from table of contents, and when retrieving information from properly-formatted PDF references.

Py2neo and Pymysql - Used to connect to the respectives databases Neo4j and MySQL to perform the database operations.

Algorithms:

Depth-First Search - Used for graph matching in Block Diagram Marking for identification of matching, additional, deleted, and substituted blocks.

Breadth-First Search - Used for graph matching to find an exact match comparison of the student’s answer with the teacher’s answer in Logic Circuit Marking, and for Simulation in Logic Circuit Marking if the teacher allows alternatives correct answers to be marked correct and an exact match has not been found.

Declaration of use of code/components not owned by you.

* To convert pdf documents for xml : pdfx v1.9 (online site)
* Python libraries
* To provide canvas: GoJS

**4.Proof Of Concept**Automating the Question Paper Marking Process is a ongoing problem in education domain for questions which require considerably lengthy answers in sentence form, as it involves the identification of the presence of key points, and checking the validity and meaning of the student’s answer against the teacher’s answer in order to allocate marks to the answer provided by the student.

Mistakes are being made usually while marking answer scripts to the exam papers. A teacher may receive many test papers to mark within a short period of time, For any exam each student’s work should be marked in the same standard.so that the right mark can be awarded to every candidate each time. It is a hard and time consuming task. The teachers should also be experts in their subject, carefully selected and well trained for exam paper marking..Sometimes teachers have to remark the test papers to check whether the student has got the right pass on the exam. By using this web based system the question paper marking can be easily done from anywhere in the world without facing any difficulties mentioned above.

When marking the online assessments in online courses, the web based system is more useful because the student and the teacher may be in different locations. Our system has another feature which is the capability of giving information for any syllabus-related question. This feature is mainly for the learning purpose of students and the students can get the answers for their doubts without waiting. The system will extract information according to the student’s grade, and knowledge. This feature helps students to improve practicing answering questions properly and face exams with more confidence. Finally, Moodle plugin is going to be developed from the system. Currently 20% of users are using the Moodle as their Learning Management System(LMS). So our main target is to build this system as a moodle plugin, and also there are other LMSs such as Black-Board (32%) and Canvas (15.3%). Our future target is to expand the usage of the system by developing plugins for other LMS as well.