Implementing E-assessment using Open CV in ∞Exams

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Abstract: *This paper features a software system called ∞Exams (Infinity Exams) which supports (primarily in higher education) paper-based examination and makes it easier, more comfortable and speeds up the whole process while keeping every single positive attribute of it but also reducing the number of negative aspects. The approach significantly differs from the ones used in the previous 10+ years which were implemented in such a way that they could not reproduce and replace the traditional paper-based examination model. The heart of the article relies on the most important element of the software which is the image processing flow.The way of conducting testing the knowledge of a person using Multiple Choice Questions (MCQ) has been increased gradually. In Educational industries (like schools and colleges) it is more common now days having tests using multiple choice questions. Even in conducting interviews it is used. Current day scenario is either using OMR technology to correct the test or manually. In real-time it is quite difficult to have OMR at all the time and manually it is highly taking the time to correct and it may give you the error. We address this issue, in our proposed system we using digital image processing technique to correct the answer using multi choice question in python. We are here using Open Source Computer Vision Library (Open CV) to process and correct the answer. Python is the best language to implement this concept with the available Open CV library. In this system we also implement in the django environment.*

Keywords: *About E-assessment, computer-based assessment, computer-assisted assessment, computer-aided assessment, examination, exam, image processing*

I.   Introduction

There is a growing need for storing paper-based information digitalized nowadays. This problem concerns education as well but it does not always get enough attention, however using our technology accordingly many aspects of the educational process could be made a lot simpler, easier, faster, more comfortable and (partially) automatable.

Most of the educational institutions are using traditional teaching and examination methods in most of their subjects still. Though the digitalization of teaching got a little bit of attention in the previous years and began its growth since then. Alongside it there are also computer-based examination methods but it is not the main functionality of the e-learning systems. So mostly the traditional examination models are used concerning those subjects who require such a way to be examined accordingly. From now on the paper-based examination method will be discussed, since it is the main concern of this paper. The keyword "e-assessment" refers to electronic assessment as software is used to mark the exam papers filled by the students after the exam is completed.

Multiple choices Question (MCQ) are a form of an objective assessment in which respondents are asked to select only correct answers out of the choices from a list.[1] The multiple choice format is most frequently used in educational testing, in market research, and in elections, when a person chooses between multiple candidates, parties, or policies.

In this paper we are using image processing to accomplish the MCQ correction in very easy manner. It produces the great effort to deal to remove the barriers of multi choice assessment correction. In this we are using array format to correct the answer paper which is photo copier and uploaded by user. The main concept is to get the image and get the answer which is shadowed by user.

In Python Open CV library is available for image processing. In order to get the best effective output we use the django framework along with python. The Open CV is a library of programming functions mainly aimed at real-time computer vision. The Following topics are organized to explain the process of how to deal with this technique.

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II. Related Work

A. Classifications of related systems

The primary classification is based on the main functionalities of the given system as follows:
1. Computer-based examination and assessment systems
2. Computer-based assessment systems

It is trivial that the former group of systems gives a wider solution and it even seems better and easier to do the whole process this way but it is not in every case for certain, moreover usually it is not even worth it. Though it implies that most of the related work in the previous 10+ years discusses these kinds of systems, since these should be the real future of computer-based education Nowadays the examination part of these systems is too futile and only in special cases (e.g. multiple-choice tests) can it fully reproduce the way of its paper-based equivalent. For example, in the USA they wanted to have these kinds of systems in every school and they wanted to make it obligatory to take exams this way but the plan have not gone accordingly because many states reported malfunctioning systems and other problems concerning these software systems, so they had to cancel this whole plan [1].

Both categories of the previously stated systems can also be viewed from another aspect since both are also assessment systems which have a so-called intelligence of evaluation. According to the intelligence of evaluation the classification is as follows [2; 3]:
• Manual evaluation, the evaluation of the solutions is done manually, by human resources.
• Quasi-automatic evaluation, the system is able to evaluate the major part of the solutions automatically, still a smaller part of them are evaluated by the teacher.
• Automatic evaluation, the system is able to evaluate all answers automatically.

B. Computer-based examination and assessment systems

As it was mentioned earlier most of the related work consists of this class of approach to the problem but below only one of these is highlighted. The reason and the summarization of the highlighted system lie below.

The so-called eMax [2; 3; 4; 5] system which was also made under the roof of Obuda University, John von Neumann Faculty of Informatics, provides quasi-automatic evaluation for short text answer questions and special maths tasks. The text can be any input from a keyboard but at the maths tasks there is a required syntax which must be followed to ensure the maximum efficiency of the evaluation algorithms. Because of this restriction many students were not able to adapt well enough to the ways of the system and also the system only proved useful enough in a few cases so the envisioned functionality of the software was not realized. Today the system is still used but sadly not the way it was meant to be. The problems of similar solutions are discussed in [6].

C. Computer-based assessment systems

There are some works concerning this class of assessment systems as well but not all of them are completed ones [7] or just simply solve a specific problem this way [8]. As previously only one of these is highlighted below but this time there is no personal connection to it. It is just one of the better ones found during the research.

The paper which will be mentioned already states its approach in its title: "Blended e-assessment: Migrating classical exams to the digital world." [9]. It makes the reader sure about what is the aim of the work; it simply is almost the same as mine. It has a strong argument about the usefulness and importance of such software and even presents the completed software, moreover summarizes some years of experience with the system with the experiences of the students and the teachers. It also features some key solutions in the software itself which mostly only make it more user-friendly but because of this some of my early thoughts of such software got verified.

III. Methodology

∞E*xams* is a computer-based assessment system using manual evaluation and containing the following features:
• Teacher and student user interfaces, login options.
• Teachers, students, exams can be added and modified.
• Generation of special exam sheets and all of its components including QR codes.
• Upload of scanned images of a given exam, automatic image processing of these files and preparing them to be corrected by the teachers.

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• Automatic generation of exams with the help of the given QR codes if an exam is not present in the system and sorting of the processed images by exams and by students.
• Exam correction interface for the teachers.
• The end results of the individual exam papers are automatically generated with the help of the given correction of a teacher. Summarized end results are also calculated and different statistics can be viewed by anyone.
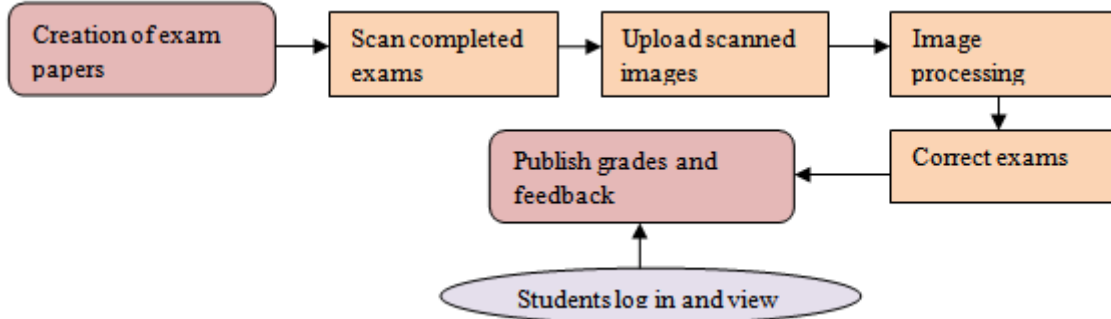

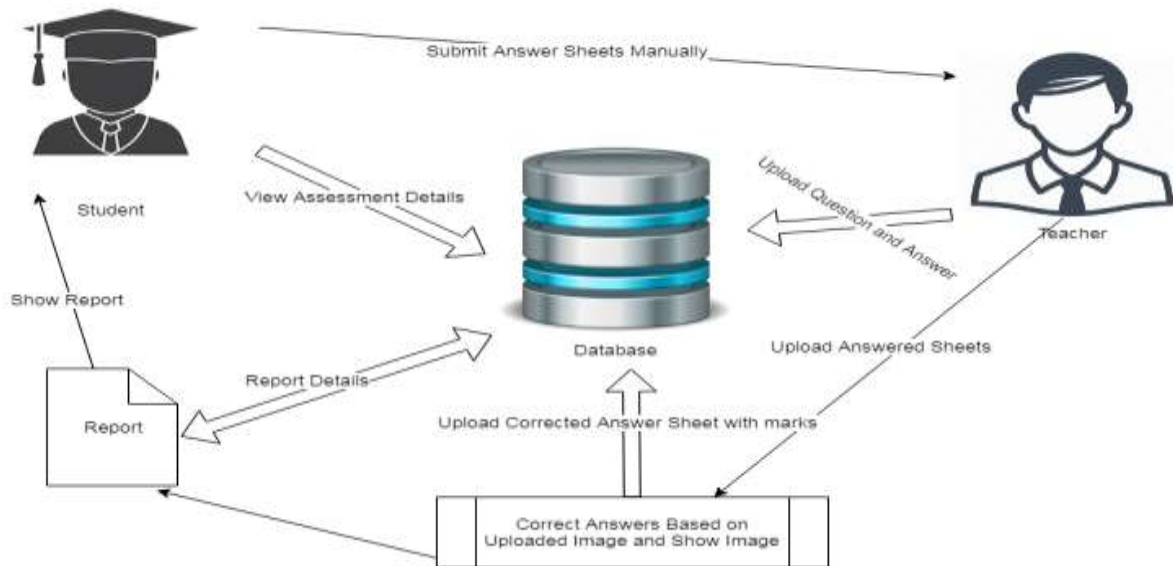***Figure1.*** *Users Functional model image*

Figure2: *Architecture*

MODULES:
This application has four modules which are listed in the following.
1. Student Management
2. Exam Assessment
3. Result Details
4. Graph Analysis

MODULE DESCRIPTION:
In this project there are four modules to achieve our expected result. These are the major functionalities of the project. The registration and login process are important to access the project for both users. There are two users' admin (Teacher) and user (Student).

1. Student Management
The students are not directly registered. Faculty is uploading the bulk details of students with details of name, student id, class and so on. Students will receive manually student id from faculty manually. With the

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username and student id as password, student can authenticate to access the details. The details can be modified by students not by faculty at the same time student cannot modify their student id which given to them.

2. Evaluation using Image Processing

The Faculty will upload the students answer sheets as photos. Those photos can be evaluated with the help of Digital Image Processing technique. It can be achieved with the help of python's opencv library. The matrix form is created with answer key to identify and give the result as per the photos.

3. Result Analysis

The results from the above module are handled by some math functions to put those values into calculations. Get the total marks accomplished by students and average of the student can be calculated by the auto functionalities and display to users.

4. Graph Analysis

The graph analysis is done by the values taken from the result analysis part and it can be analyzed by the graphical representations. Such as pie chart, pyramid chart and funnel chart here in this project.

IV. Conclusion

The featured so-called ∞Exams software system is in alpha version which means that the previously envisioned functionalities have been partially implemented and can be used. The software has a desktop application in which the users can generate exam sheets, browse and edit the database, upload images and correct the exams. The already implemented framework gives a nice look at how the whole system will be assembled. At this very moment, the software can only be used in offline mode.

The functionalities of the system have already been tested with more than a 100 exam sheets filled out by students solely for this purpose. The image processing part of the system has given satisfactory results as it seemed fast enough to process even a massive number of images at once without a single error.

It is beyond doubt that the further development potential of the ∞Exams software system is great and by seizing this opportunity, when it will be completed and released, it could play a considerable role in the future of the revolution of the digitalization of education.

The MCQ Test correction is major way of assessment in the current scenario. MCQ Test format have different way of correction and conducting the tests which is very difficult. The proposed system addresses the issue and solving this problem with the help of Image Processing and Django Framework. Both of these techniques were very handy to solve the problems in MCQ Test Correction. It has its own limitations which are solved in future but as for current scenario it is better solution among the existing ideas.In future can able to have many services to be included in this application.

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