E-OMR ASSESSMENT USING IMAGEPROCESSING

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Abstract.

E-OMR system which supports 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 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-a-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 are using digital image processing technique to correct the answer using python. We are 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: Image Processing, Multiple Choice Test, OpenCV, Optical Mark Recognition, Python

1. Introduction

1.1 About Project

There is a growing need for storing paper-based information digitalized now-a-days. This problem concerns education as well but it does not always get enough attention, however using technology accordingly many aspects of the educational process could be made a lot simpler, easier, faster, more comfortable and (partially) automatable. A fast, reliable and cheap method is suggested for the recognition and evaluation of the marks of a multiple-choice test on the images that are obtained via the scanning of the optical forms printed on a standard sheet of paper with an ordinary scanner. This method is called the recognition of optical marks and is the process of capturing the data on the multiple-choice forms. The application of recognition has been developed by using the software language, Python and the image processing library, OpenCV. When the answer sheet is loaded in the application, incorrect answers are marked as red while the correct ones as green and with the calculation of the correct/incorrect answers and blanks, the result is printed on the optical form image. This method is economical, fast and quite successful. The empirical studies have shown that the suggested system is more successful than the conventional optical mark recognition systems regarding accuracy, reliability and performance.

1.2 Objectives of the Project

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 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 which require such a way to be examined accordingly .E-Assessment refers to electronic assessment a software is used to mark the exam papers filled by the students after the exam is completed

1.3 Scope of the Project

It produces the great effort to deal to remove the barriers of multi choice assessment correction. 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.
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2. Literature Survey

2.1 Existing System

The Multiple choice Question Pattern is most widely used to assess the details which are necessary. In current scenario Optical mark recognition (OMR) is most widely used to deal with multiple choice questions. But OMR sheets are corrected by the specialized machines to correct the answers. If dealt it in manually it will be very difficult to handle the data and accuracy also questioned. The manual work needed more effort, time and concentration to make it perfect. The existing system is dealing with many disadvantages.The Main disadvantage of existing system is the necessity of the OMR machine to correct the answer. On the other hand the manual work is heavy and problems to deal with accuracy, time delay and people management.[3].

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. 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 :

• 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[6]

The eMax 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.[9]

Every paper contains some essential information about the given exam and about the one who took the exam on the given paper. All of this is represented in the header of the paper where a QR code can be found containing all the information about the exam and six cells as well where the students must put their identification codes. Also, if there are different groups of papers it is also represented in the QR code but the teachers are not expected to scan each and every one of these so instead it is represented as a big Latin letter beside the QR code. Each paper contains different number of tasks which are separated by horizontal lines from each other. There is also a vertical line present which makes a margin on the paper and to which the number and letter of the given task is stuck. Each paper has a footer which contains essential information about how to use the paper accordingly during an exam[7;8]

A nonparametric and unsupervised method of automatic threshold selection for picture segmentation is presented. An optimal threshold is selected by the discriminant criterion, namely, so as to maximize the separability of the resultant classes in gray levels. The procedure is very simple, utilizing only the zeroth- and the first-order cumulative moments of the gray-level histogram. It is straightforward to extend the method to multithreshold problems.[5]

Binarization plays an important role in digital image processing, mainly in computer vision applications. Thresholding is an efficient technique in binarization. The choice of thresholding technique is crucial in binarization. Binarization generally involves two steps including determination of a gray threshold according to some objective criteria and assigning each pixel to one class of background or foreground. If the pixels intensity is greater than the determined threshold then it belongs to foreground class and otherwise to the background[10].

An image may be defined as a two-dimensional function, f(x,y), where x and y are spatial (plane) coordinates, and the amplitude f at any pair of coordinates (x,y) is called the intensity or gray level of the image at that point. When x, y and the intensity values are all finite, discrete quantities, we call the image a digital image, and digital image processing refers to processing digital images by means of a digital computer.The smallest element of an image is called a pixel. There are different types of images used for digital image processing. They are:

A. GRAYSCALE IMAGE This type of image uses 1 byte per pixel, and each pixel intensity ranges from 0-255.

B. COLOR IMAGE It uses 3 bytes per pixel, as it has three components Red, Green and Blue. The intensity range of each component is also 0- 255.

C. BINARY IMAGE It uses only 1 bit per pixel. The pixel value is either 0 (for black pixel) or 1 (for white pixel).[2]

The Canny edge detector is widely used in computer vision to locate sharp intensity changes and to nd ob ject boundaries in an image The Canny edge detector classies a pixel as an edge if the gradient magnitude of the pixel is larger than those of pixels at both its sides in the direction of maximum intensity change.[1]

Digital image processing has become an applied research area that goes from professional photography to several different fields such as astronomy, meteorology, computer vision, medical imaging, among others. The aim of digital image processing is to improve the pictorial information in order to perform subsequently other tasks such as imagebased classification, feature extraction or pattern recognition. Image processing is usually an expensive and time-consuming task, for example in point to point processing, a grayscale image of 1024×1024 pixels, will require a CPU make to more than one million operations, and if it is a color image the number of operations must be multiplied by the number of channels.[4]

2.2 Proposed System

The proposed system is taking the digital image of the answer sheet in the given pattern and uploads to the given system. In order to correct the answer digital image processing is used to get the answer sheet and proceed it to read the image. This method avoids the machine dependency and people dependency in high manner. This system brings out the effectiveness by using Django framework along with python in order to do image processing. The major impact is open CV library, which is available to access the image and make that very effective to deal with correcting answers in the image

3. Proposed Architecture

E-Assessment is a computer-based assessment system contains the following features:

- Teacher and student user interfaces, login option.
- Teachers, students, exams can be added and modified.
- Uploading of scanned images of a given exam, automatic image processing of these   files and preparing them to be corrected by the teachers.
- 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
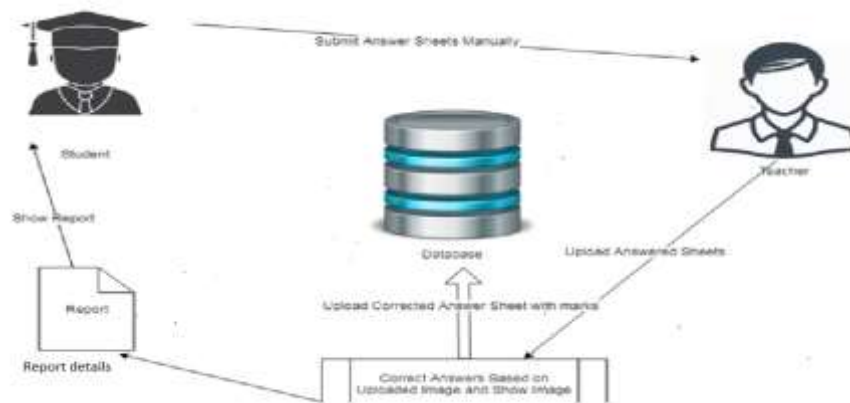
Fig.3

shows the System Architecture

3.1 Modules.

There are four modules . The registration and login process are important to access the for both users. There are two users admin (Faculty) and user (Student).

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 student id from faculty manually. With the username and student id as password, student can authenticate to access the details. The details can be modified by students not by faculty.

Evaluation using Image Processing

The Faculty will upload the students answer sheets as images. Those images can be evaluated with the help of Digital Image Processing technique. It can be achieved with the help of python's opencv library.

Result Analysis

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

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
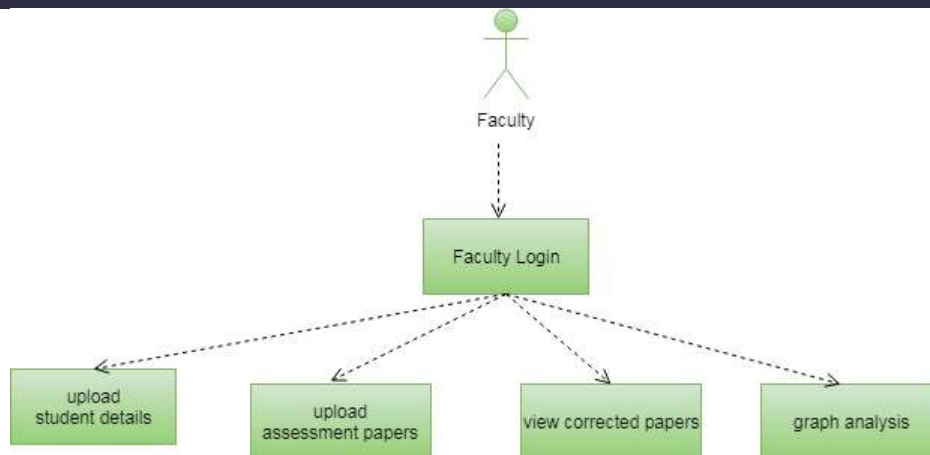
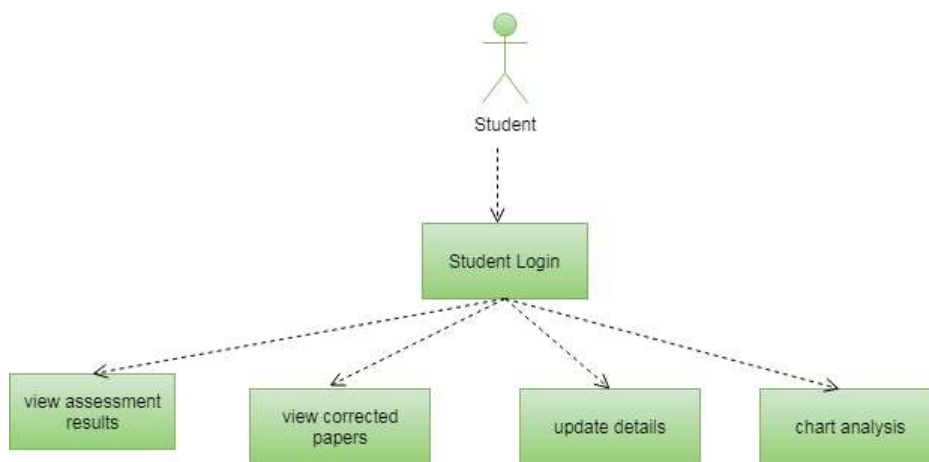Fig 3.a:Use Case diagram:Faculty

Fig 3.b:Use Case diagram:Student

4. Implementation

4.1 Algorithm

The process of separating the foreground pixels from the background is called thresholding. There are many ways of achieving optimal thresholding and one of the ways is called the Otsu's method, proposed by Nobuyuki Otsu's method is a variance-based technique to find the threshold value where the weighted variance between the foreground and background pixels is the least. The key idea here is to iterate through all the possible values of threshold and measure the spread of background and foreground pixels. Then find the threshold where the spread is least.

Otsu's method is an algorithm to automatically find the optimal threshold intensity which separates the image into 2 classes foreground and background

Otsu's Thresholding Concept

Automatic global thresholding algorithms have following steps.

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- Process the input image

- Obtain image histogram (distribution of pixels)

- Compute the threshold value

- Replace image pixels into white in those regions, where saturation is greater than T and into the black in the opposite cases.

The algorithm iteratively searches for the threshold that minimizes the within class variance, defined as a weighted sum of variances of the two classes (background and foreground). The colors in grayscale are usually between 0-255 (0-1 in case of float). So, If we choose a threshold of 100, then all the pixels with values less than 100 becomes the background and all pixels with values greater than or equal to 100 becomes the foreground of the image.

Sorting contours

Sort contours according to their size/area, along with a template to follow to sort contours by any other arbitrary criteria.Sort contoured regions from left-to-right, right-to-left, top-to-bottom, and bottom-to-top using only a single function.

Perspective Transformation

We provide the points on the image from which want to gather information by changing the perspective. We also need to provide the points inside which we want to display our image. Then, we get the perspective transform from the two given set of points and wrap it with the original image.

Countours technique

Step 1: Detect the exam in an image.

Step 2: Apply a perspective transform to extract the top-down view of the exam.

Step 3: Extract the set of bubbles (i.e., the possible answer choices) from the perspective transformed exam.

Step 4: Sort the questions/bubbles into rows.

Step 5: Determine the marked (i.e., "bubbled in") answer for each row.

Step 6: Lookup the correct answer in our answer key to determine if the user was correct in their choice.

Step 7: Repeat for all questions in the exam

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5. Result
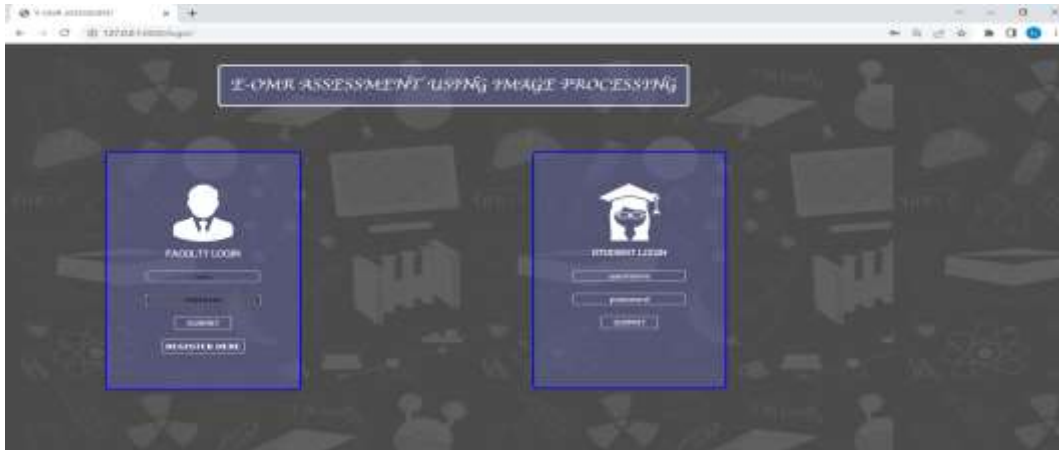

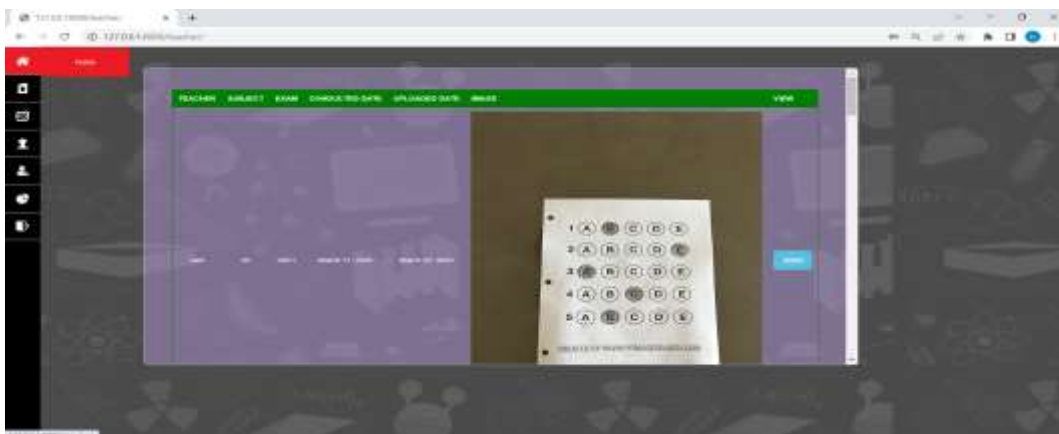Fig5a:Thehome page consists of two login options faculty and student

Fig5b

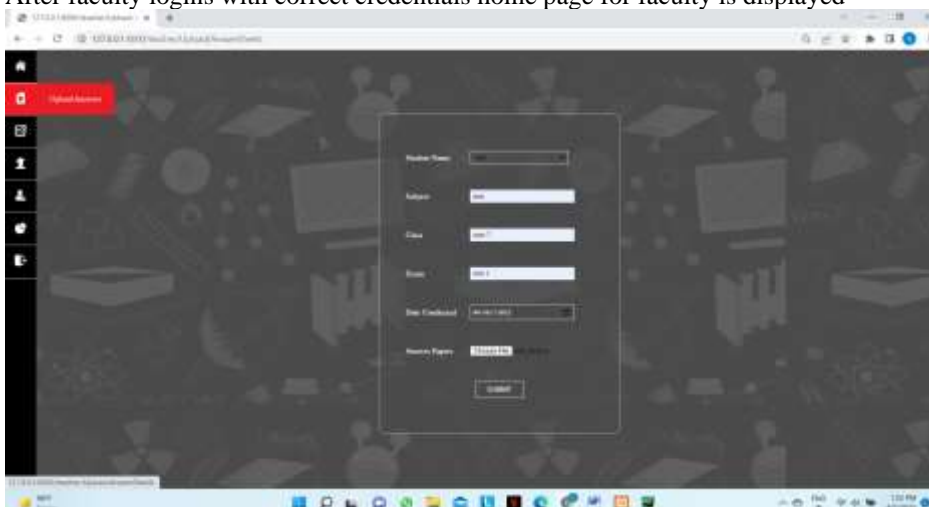After faculty logins with correct credentials home page for faculty is displayed

Fig 5c For uploading the answer sheets student name is selected from the drop down .The following details like subject ,class,exam,date of conducted ,answer papers are entered
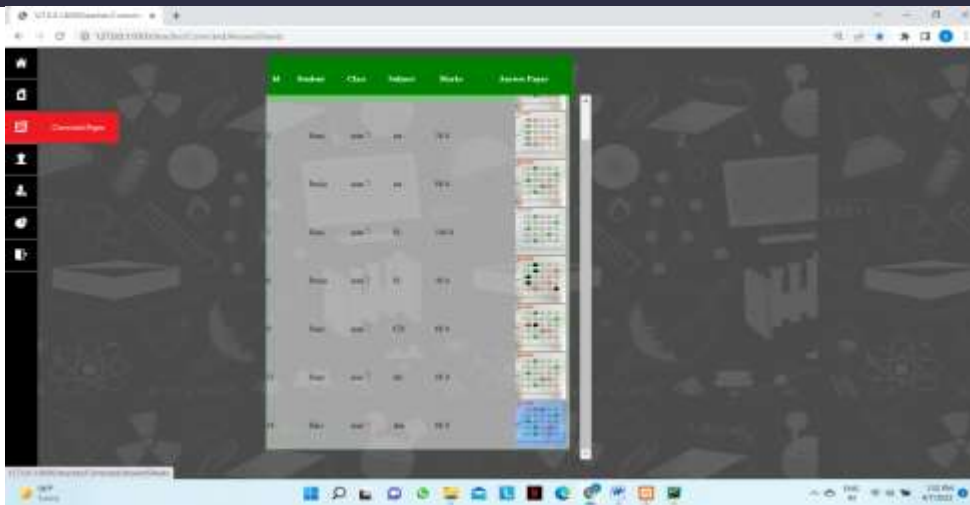
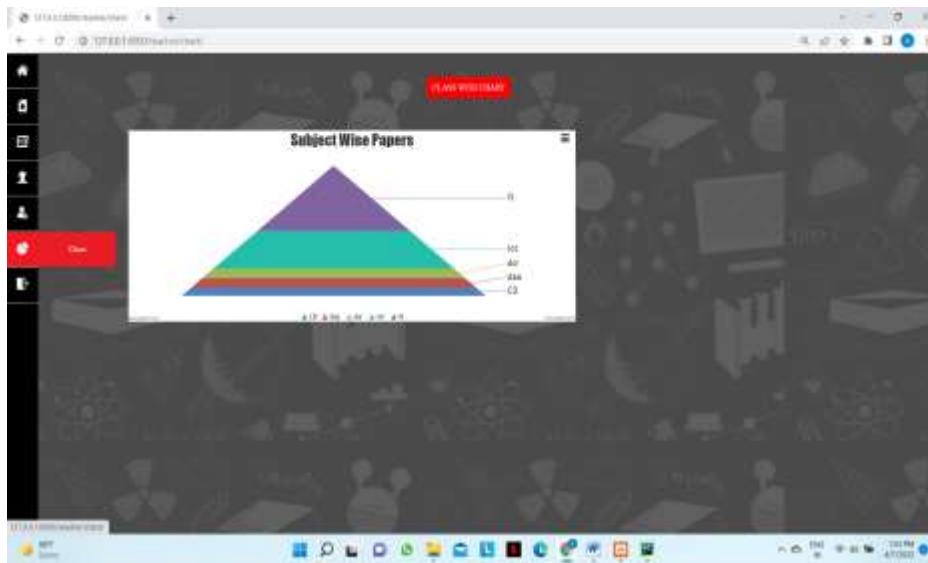Fig 5d shows the list of corrected papers of different students
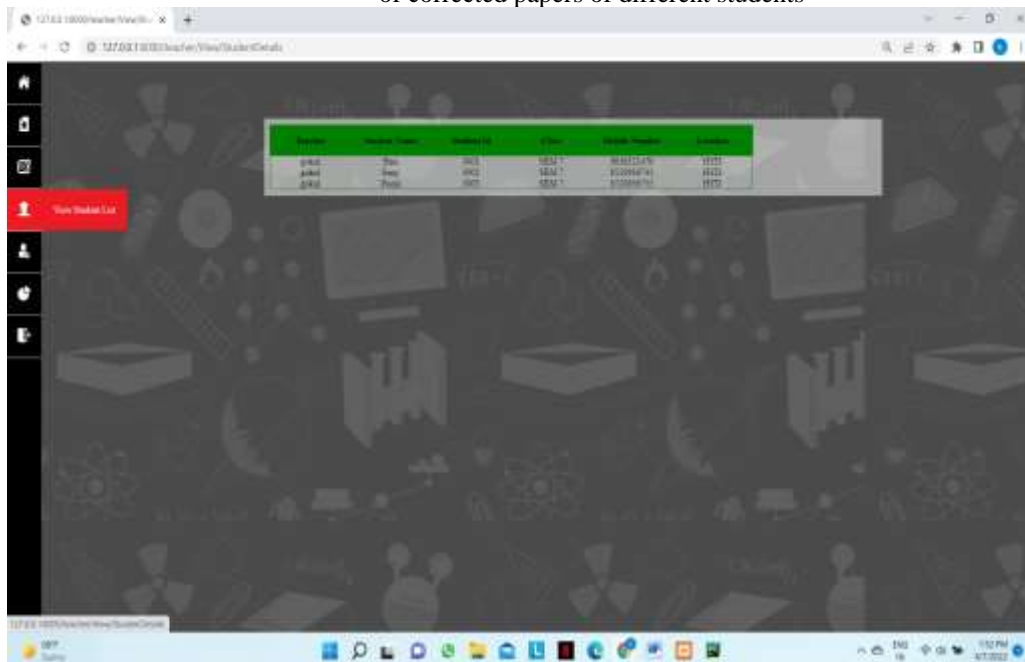
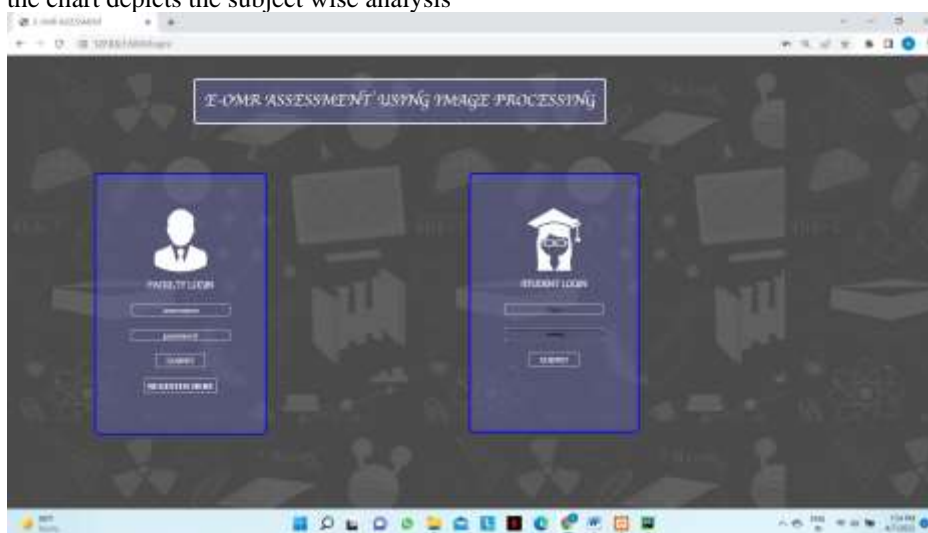Fig 5e shows the student list consists of following details like student name,id,class,mobile number and location

Fig 5f shows the faculty can upload the list of students

Fig 5g shows the chart depicts the subject wise analysis

Fig 5h shows the students can login using student name and id as password
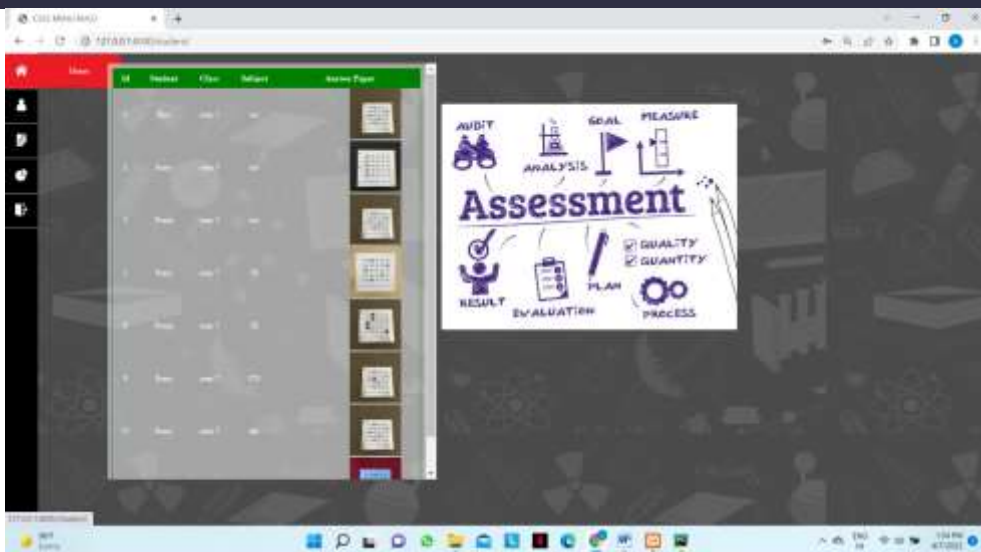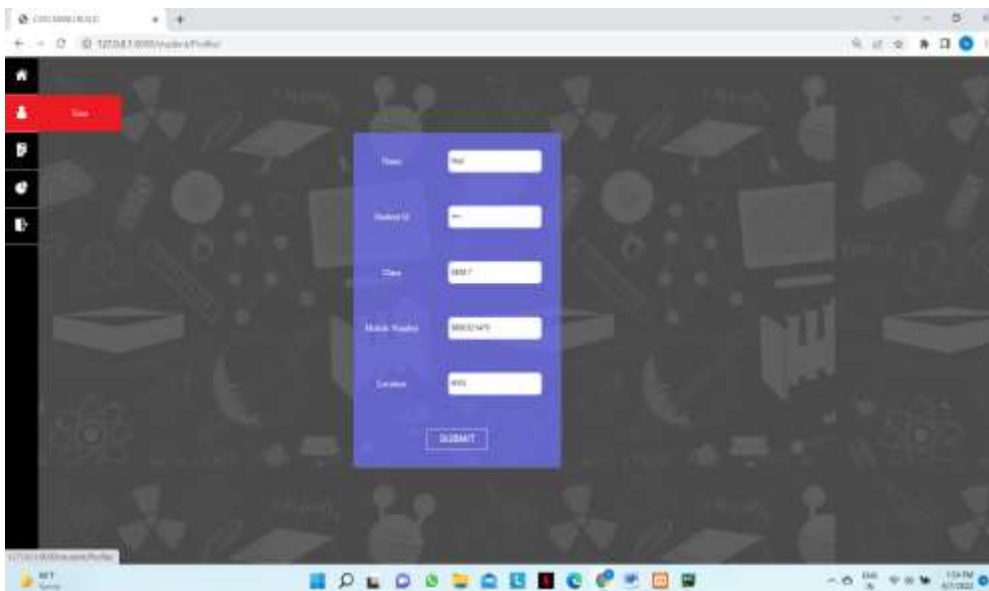
Fig 5i shows the student home page

Fig 5j
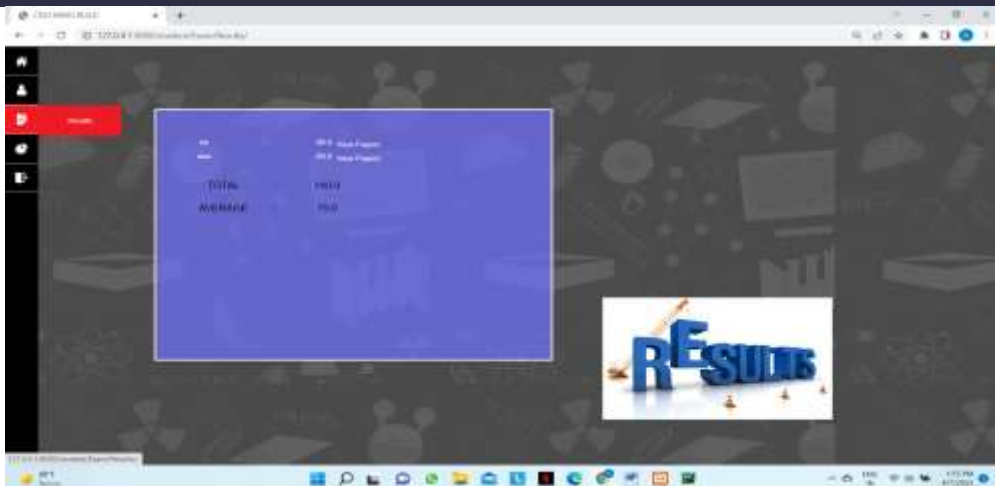shows the students can update their details except student id

Fig 5k shows the students can view their marks of each subject in result page.The total and average is calculated
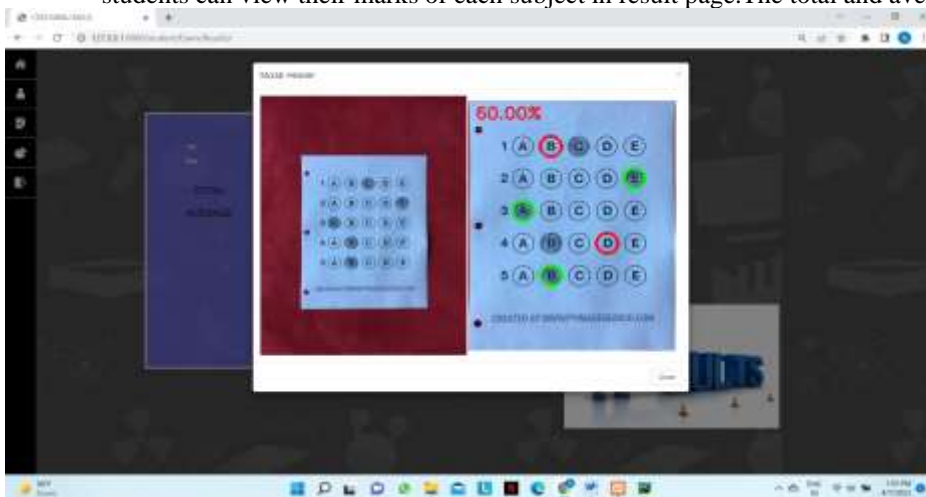

Fig 5l shows the Omr Correction is shown where right answers are circled in green colour and wrong answers in red color
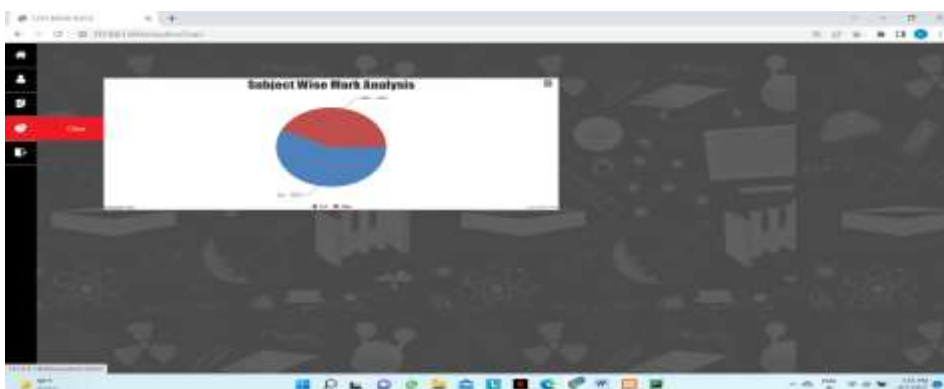

Fig 5m shows the subject wise chart

6. Conclusion

This system has an accuracy of 88% and can successfully detect the marked circles or bubbles in the OMR(Optical Mark Recognition) and can easily be replaced as a initial grading tool for education purposes and many more. The time taken by the proposed system is approximately 60 seconds max, which means time can be saved and the cost to invest in heavy OMR sheet scanning machines.

This system proposed can be used to provide an efficient way to evaluate the answers sheets of various exams conducted across the globe. It also provide an inexpensive method of the user who does not want to invest lot of capital in a heavy machinery. Time being the most crucial factor of every human life this system has made a point to save it. The proven time for the system to evaluate the sheet is 60 seconds max

The featured 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 browse and edit the database, upload images and correct the exams.

7. Future Scope

The further development of the Exams software system 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.

8. References

1. [1] Ding, Lijun, and Ardeshir Goshtasby. "On the Canny edge detector." Pattern recognition 34.3 (2001)

2. [2] Krishna G, Rana H R, Madan I, Sahu R, " Implementation Of OMR Technology With The Help Of Ordinary Scanner",international journal of advanced research in computer science and software engineering, vol-3, issue- 4, April 2013

3. [3]Manikanta,Veduruparthi Venkata, pg scholar, and Ms Venugopala rao. "e-assement using image processing for infinite exams." Complexity International 24.01 (2020).

4. [4] Olmedo, Eric, et al. "Point to point processing of digital images using parallel computing." International Journal of Computer Science Issues (IJCSI) 9.3 (2012).

5. [5] Otsu, Nobuyuki. "A threshold selection method from gray-level histograms." IEEE transactions on systems, man, and cybernetics 9.1 (1979)

6. [6] Pathe, Prajakta, Sachin Choudhari, and Monali Gulhane. "E-assessment Using Image Processing in Exams." International Journal of Computer Sciences and Engineering 7.12 (2019).

7. [7] Pathe, P., Choudhari, S., & Gulhane, M. (2019). "Implementing E-assessment using Open CV in ∞Exams". International Journal of Computer Sciences and Engineering, 7(12)

8. [8] Supriya N. Kulmethe, Hirendra Hajare." E-assessment using image processing in infinity exam".2020 International Journal of Advance Research, Ideas and Innovations in Technology

9. [9] Tóth, Ádám, István Vajda, and Zoltán Vámossy. "E-assessment using image processing in∞ Exams." 2017 IEEE 15th International Symposium on Applied Machine Intelligence and Informatics (SAMI). IEEE, 2017.

10. [10]Yousefi, Jamileh. "Image binarization using otsu thresholding algorithm." Ontario, Canada: University of Guelph (2011).

11. SN Paidimarry, CKK Reddy, LG Lolla, Internet of things enabled smart baggage follower with theft prevention, Journal of Physics: Conference Series 1950 (1), 012002, 2021

12. PR Anisha, CKK Reddy, K Apoorva, CM Mangipudi, Early Diagnosis of Breast Cancer Prediction using Random Forest Classifier, IOP Conference Series: Materials Science and Engineering 1116 (1), 012187, 2021

13. RM Mohana, CKK Reddy, PR Anisha, BVR Murthy, Random forest algorithms for the classification of tree-based ensemble, Materials Today: Proceedings, 2021

14. Kishor Kumar Reddy C, Anisha P R, Shastry R, Ramana Murthy B V, "Comparative Study on Internet of Things: Enablers and Constraints", Advances in Intelligent Systems and Computing, 2021

15. Kishor Kumar Reddy C, Anisha P R, Apoorva K, "Early Prediction of Pneumonia using Convolutional Neural Network and X-Ray Images", Smart Innovation, Systems and Technologies, 2021

16. R Madana Mohana, Kishor Kumar Reddy C and Anisha P R, "A Study and Early Identification of Leaf Diseases in Plants using Convolutional Neural Network", Springer 4th Int Conference on Smart Computing and Informatics, 2020, India

17. Anisha P R, C Kishor Kumar Reddy and Nuzhat Yasmeen, "Predicting the Energy Output of Wind Turbine Based on Weather Condition", Springer 4th Int Conference on Smart Computing and Informatics, 2020, India

18. Kishor Kumar Reddy C, Apoorva K, Anisha P R, "Early Prediction of Pneumonia using Convolutional Neural Network and X-Ray Images", Springer 4th Int Conference on Smart Computing and Informatics, 2020, India

19. Viswanatha Reddy, Dr. Elango NM and Dr. C Kishor Kumar Reddy and Anisha P R, "Prediction of Diabetes using Internet of Things (IOT) and Decision Trees: SLDPS, Springer FICTA, January 2020, India.

20. P R Anisha, Dr. C Kishor Kumar Reddy, "Early Detection of Diabetes using Machine Learning Algorithms and Internet of Things: ADPA", Springer INDIA, 2019, India.

21. Dr B V Ramana Murthy , Kishor Kumar Reddy C, Anisha P R, Rajasekhar Shastry, "IOT Based Smart Stale Food Detector", Springer INDIA, 2019, India.

22. Kishor Kumar Reddy C, Anisha P R, Rajasekhar Shastry, Dr B V Ramana Murthy and Dr Vuppu Padmakar "Automated rainwater Harvesting System", IEEE ICCES, 2019.

23. Kishor Kumar Reddy C, Anisha P R, Rajasekhar Shastry, Dr B V Ramana "Comparative Study on Internet of Things: Enablers and Constraints", Springer-ICDECT, 2019.