CONVERSION OF MARKS INTO DIGITAL FORMAT USING CNNS AND ANALYSIS OF MARKS

A MAJOR PROJECT
REVIEW-2 REPORT

SUBMITTED BY,

BATCH – 2A

B. Avinash
(20331A0522)

CH. Raviteja
(20331A0530)

CH. Sampath
(20331A0536)

E. Mani Bhaskar
(20331A0553)

K. Sravani
(21335A0504)

Project Supervisor
Mr. M. Vamsi Krishna
Assistant Professor

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
MVGR COLLEGE OF ENGINEERING (AUTONOMOUS)
VIZIANAGARAM-535005, AP (INDIA)
(Accredited by NBA, NAAC, and Permanently Affiliated to Jawaharlal Nehru Technological University Kakinada)

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1. INTRODUCTION

This project aims to address the challenges associated with manual data entry and subjective analysis by introducing a robust solution for the recognition of marks and their seamless conversion into a digital format using CNNs. By harnessing the power of image processing and deep learning, this system seeks to automate the extraction of student marks from scanned mark sheets, thereby streamlining administrative processes and minimizing errors arising from human intervention.

In this phase of the project, major emphasis has been placed on the design analysis and partial implementation of the project. In the design phase the interfaces of the software have been designed in a design tool called Balsamiq. On the other hand partial implementation of the software includes implementation of the UI interfaces and segmentation of images containing digits.

2. DESIGN & ANALYSIS PHASE

The tool that has been used to design the upcoming interfaces is Balsamiq. The main reason for opting for this particular tool is its ease of use and has most of the major components pre-built and ready to use. By using this tool, a lot of time was saved and a major advantage of using this tool, is its design is not particularly realistic nor does the design need to imitate exactly to its precision. Due to that there is room for changes and improvements.

2.1 Interface design of Data Entry:

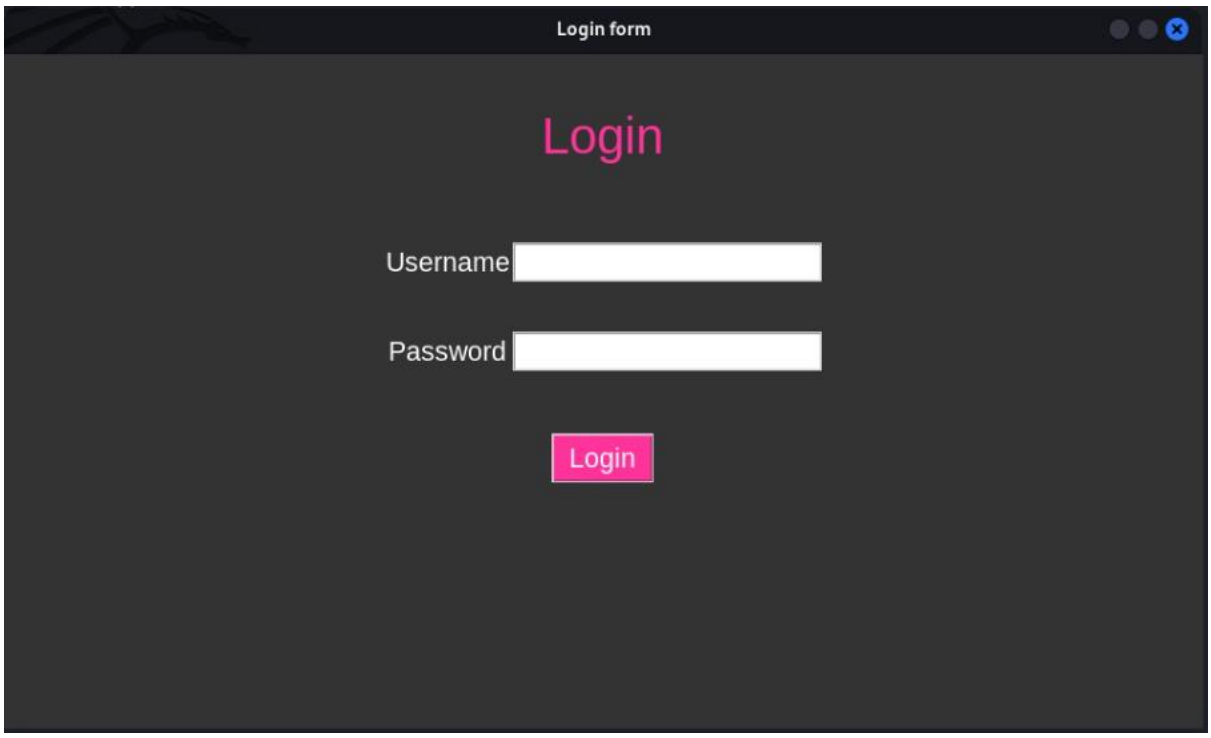

Figure 1: Login form for access of GUI

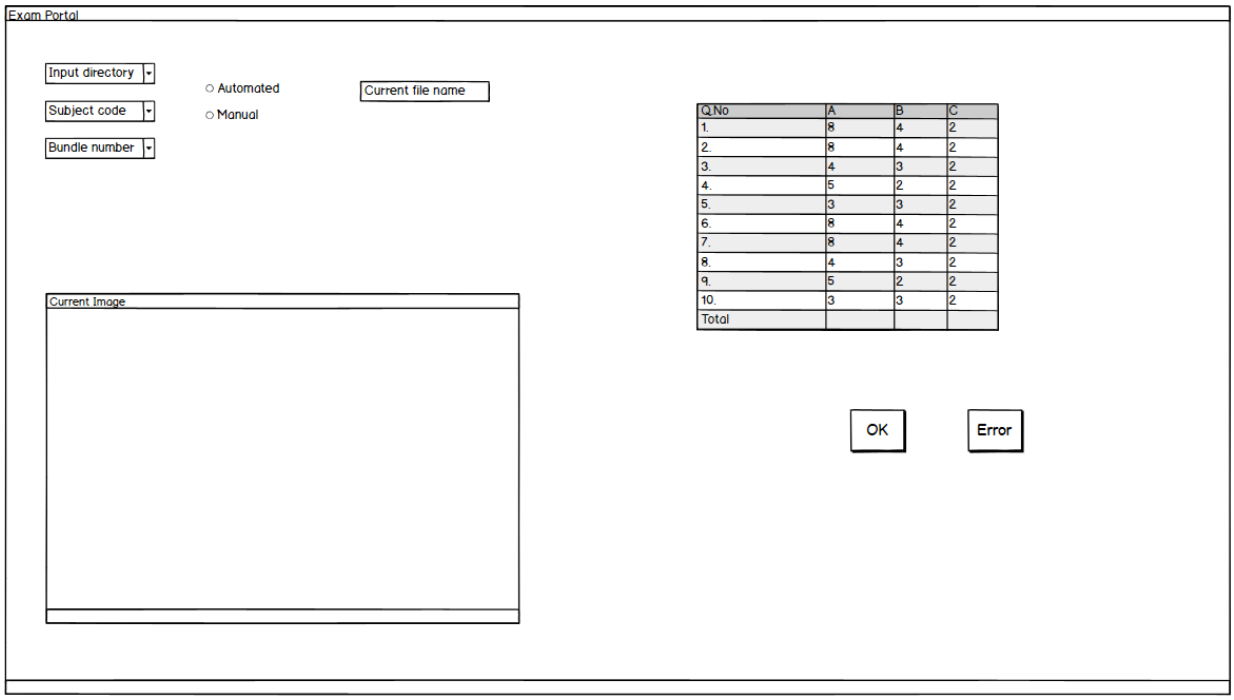

Figure 2: GUI for data entry

2.2 Interface for viewing data:

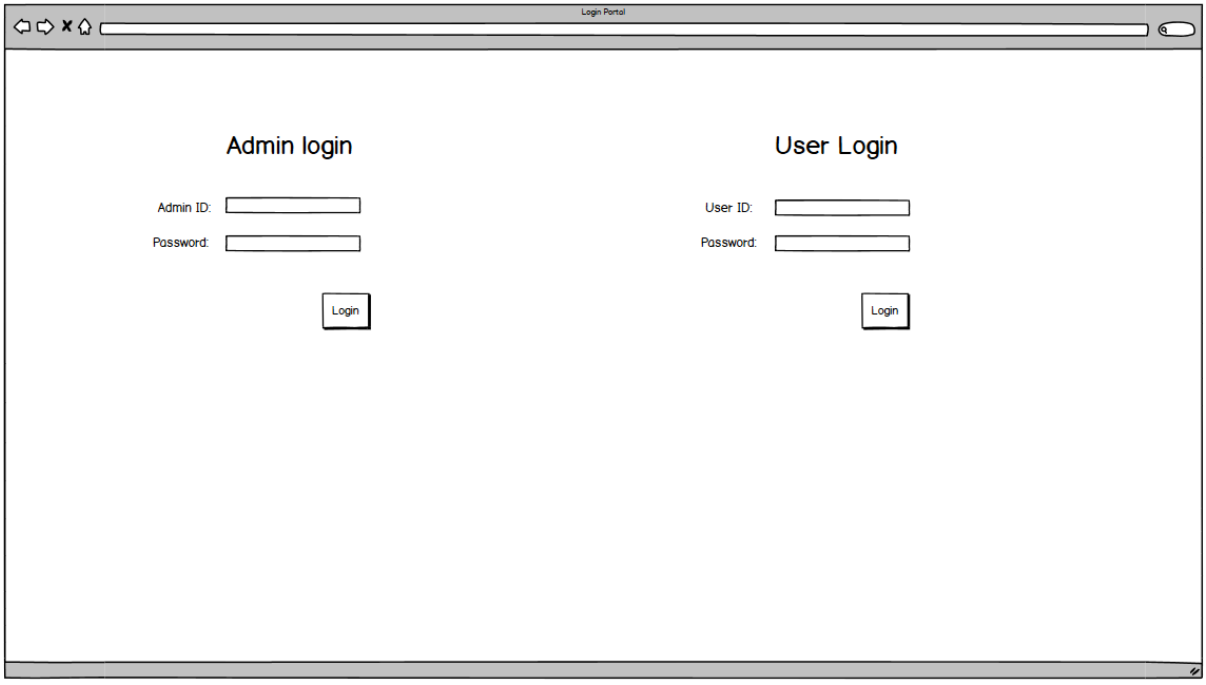

Figure 3: Login form for web view of data

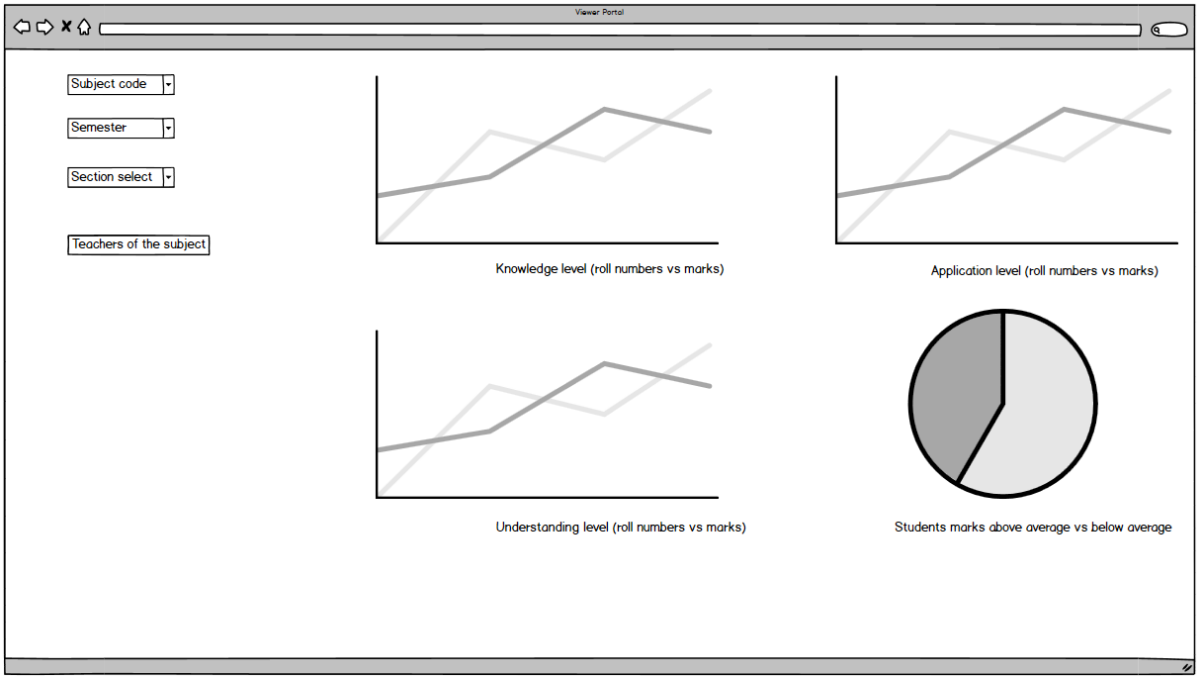

Figure 4: Statistics of the data based on filters.

2.3 Use Case Diagrams:

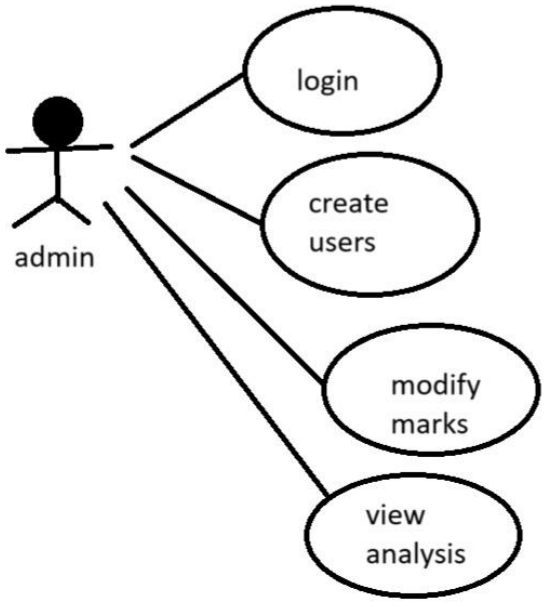

Figure 5: Use case diagram of Admin (ACE-3)

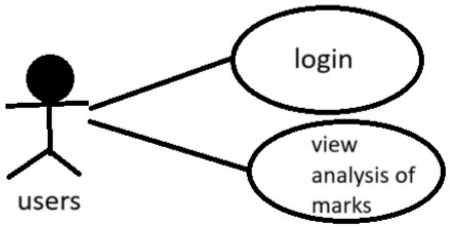

Figure 6: Use case diagram of viewers.

2.4 Sequence Diagram:

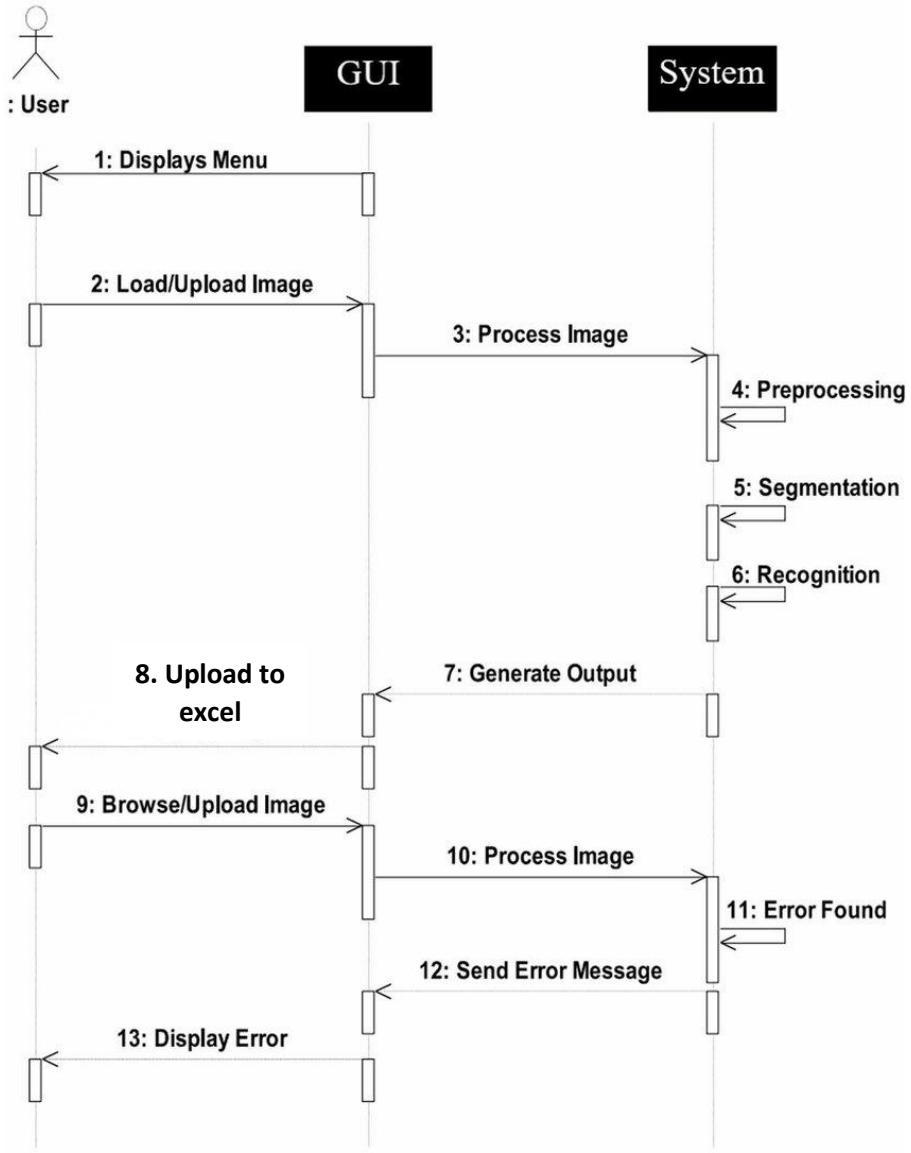

Figure 7: Sequence diagram of interacting with GUI.

3. PARTIAL IMPLEMENTATION OVERVIEW

3.1 Implementation of Segmentation:

To implement the segmentation, we have used multiple methods with varying results.

1. The first method that has been implemented is using the concept of edge detection. Here the open cv module in python is used, specifically the splitting of the image to red, green, and blue components. The objective was to detect the edges of all the rectangular boxes, evidently it might seem to work, but no matter what thresholds were put, the edges of the sides of rectangular boxes overlap with another ones, due to which we can't calculate the exact position of the rectangular box.

Figure 8: Detection of contours using CV2.

2. The second method we have opted is to implement cropping with respect to a black square that is present at 4 corners of all images, but the one big disadvantage is that resolution of images was varied in both X and Y coordinates by +- 20 pixels and also the cropping of each image may vary, and black square may be cut off from the original image.
   The algorithm first discovers the black square by finding its centre and relative to the centre, we try to crop the image.

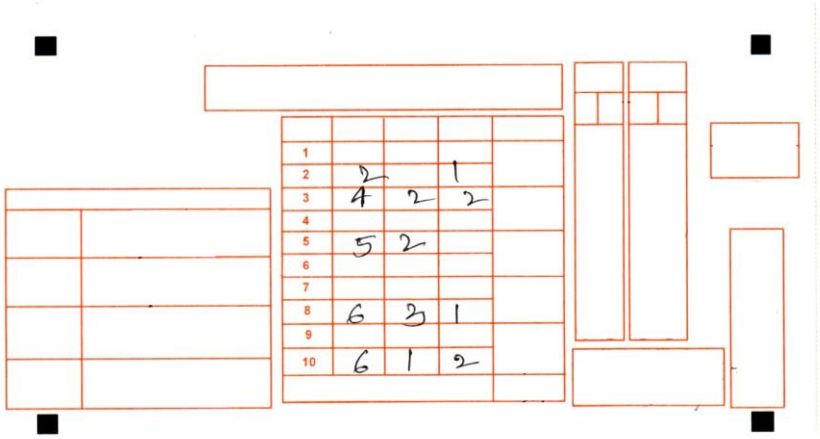

Figure 9: Sample of the black squares.

3. Finally, the best method we have found was to normalize the size of the image, we have decided that whatever may be the size of the image, it will be resized to 16: 9 ratios. The reason we have settled on this ratio, is that most of the images are approximately of that size. Once normalized, the images are then cropped relative to the new size. Even though it might be not as accurate as getting the exact coordinates, but the region of intrest is always found out.

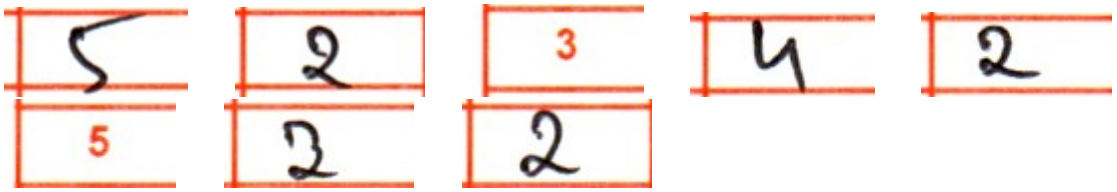

Figure 10: Sample of outputs from the segmentation

   Therefore, this is the method that we have decided to use this method of segmentation.

3.2 Implementation of UI interfaces:

To implement the specified UI design (Figure 2), we have chosen to use the Tkinter module in python, the reason we have opted to choose Tkinter over other designing tools is its ease of integration in python specifically because it's the base of our backend code and the UI interface

must be able to seamlessly integrate with the backend code. Compared to other designing tools Tkinter is a difficult to design and make it look aesthetically pleasing, but the functionality of this module is what makes it appealing to us.

4. PROGRESS AND CHALLENGES

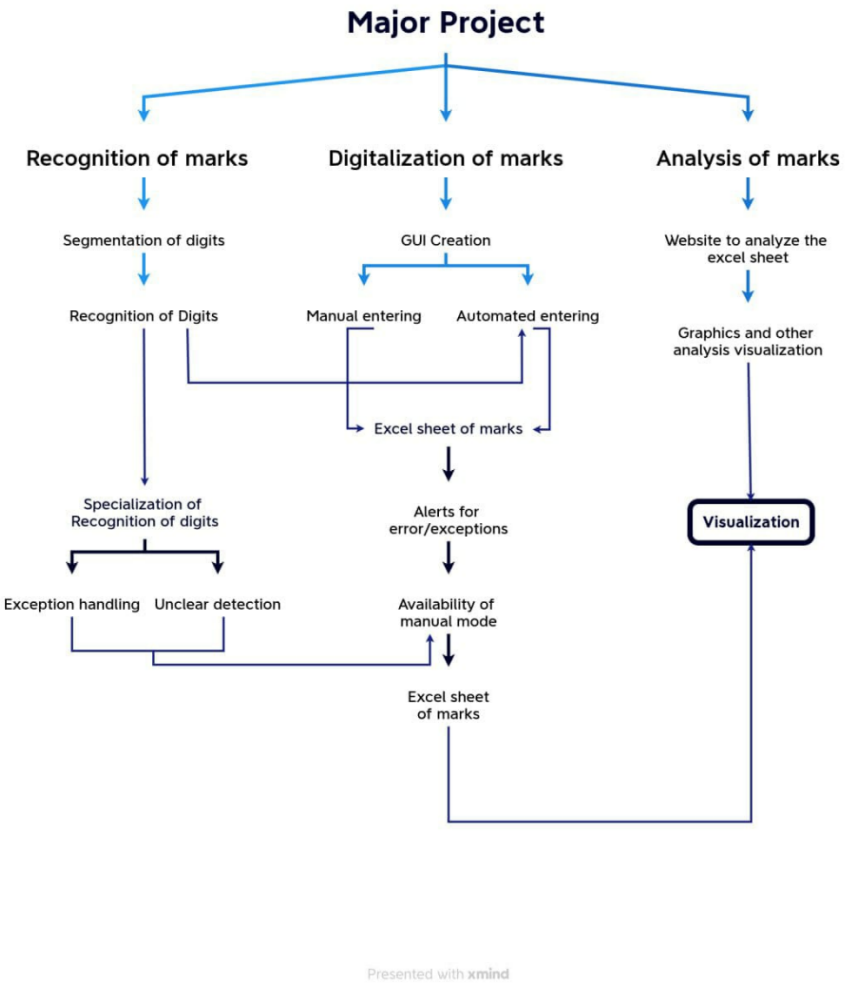

Figure 11: Previously planned.

Evidently, the first steps of both recognition of marks and Digitization of marks has been completed. But both have not yet been integrated.

The major challenges that were faced during this phase of the project are:

1. Segmentation of images required a lot of trail and error methods which was time consuming and tedious.

2. Due to the inefficacious methodology of the Segmentation methods, the intended result was not satisfactory which is why 3 methodologies were tested and the best method has been selected.

5. LESSONS LEARNED

During this phase of the project, it might seem that not much progress has been done, but a lot of valuable lessons have been learned during this phase such as:

1. How to use cv2 to detect any form of edges and how to adjust threshold values to perceive edges at different intensities.

2. Developing custom built algorithms to specifically segment images to our requirement, specifically the 3.1.2 methodology of using black squares as a relative point to crop images.

3. Designing the UI using Balsqamiq, has enabled us to learn how UI designing works and how this specific tool is useful for designing all components of our UI design.

4. Learned about specifically how to use Tkinter module in python for implementation of the UI design.

5. Finally, we have also understood the significance of how important it is to explore all available options and also how to use trail and error methods.

6. NEXT STEPS

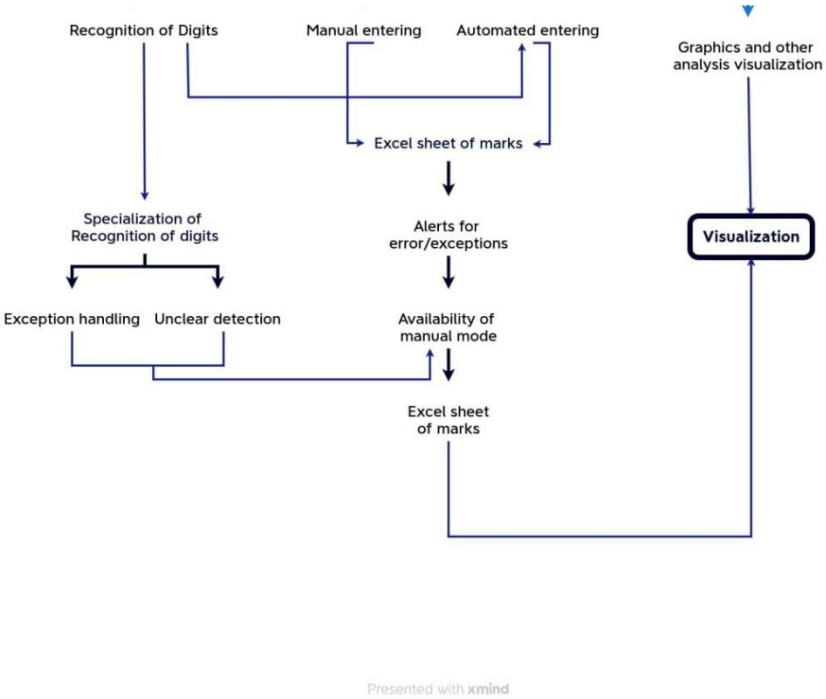

Figure 12: Next Steps.

Firstly, the next phase of the project involves recognition of digits using CNNs. The most significant step that needs to be immediately is to enable GPU based training for CNNs and using Theano module for CNNs.
Secondly, the integration of all the GUI components of TKinter module with the machine learning algorithm needs to be done in the next stage.
Finally, the visualization of analysis, will be done in react native, as its easy to implement.

7. REFERENCES

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2. A Method for Improving CNN-Based Image Recognition Using DCGAN
https://cdn.techscience.cn/files/cmc/2018/v57n1/20181019035712_68114.pdf

3. Recognition of Handwritten Digits
https://neuralnetworksanddeeplearning.com (Author – Michaeal Nielsen)

4.

8. CONCLUSION

In conclusion, utilizing Convolutional Neural Networks (CNNs) for converting marks into digital format offers a transformative solution, enabling efficient and accurate digitization of academic records. Through advanced image recognition techniques, CNNs enhance the speed and precision of data conversion, ensuring reliable analysis of student marks. This technology not only streamlines administrative processes but also facilitates in-depth analysis, empowering educational institutions to gain valuable insights for student performance evaluation and curriculum enhancement. Embracing CNNs not only marks a significant leap in digitization but also paves the way for data-driven decision-making in the education sector, ultimately fostering a more responsive and adaptive learning environment.

Role	Faculty Name	Designation	Signature
Supervisor	**Mr. M. Vamsi Krishna**	**Assistant Professor**	
Project Coordinator	**Dr. P. Rama Santosh Naidu**	**Senior Assistant Professor**	
PRC Faculty-1	**Mrs. B. Aruna Kumari**	**Associate Professor**	
PRC Faculty-2	**Mr. Surya Prakash**	**Assistant Professor**	
PRC Faculty-3			

Head of the Department
Computer Science and Engineering
MVGR College of Engineering(A)
Vizianagaram