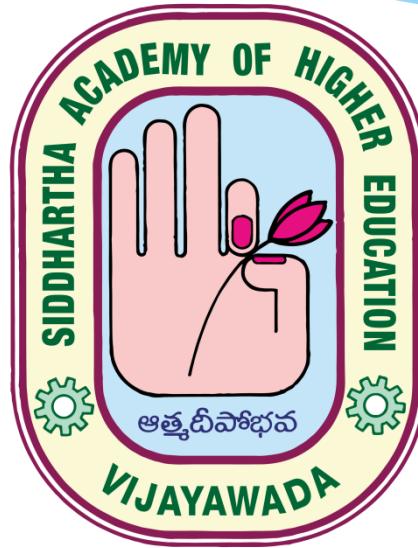# Department of Artificial Intelligence and Data Science

DESIGN THINKING AND INNOVATION
(23ES4152)

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Scenario

At a college, Professor Arun faces challenges in manually grading 150 Java exam papers, which is time-consuming and inconsistent. To resolve this, the college implements an Automated Theory Paper Evaluation System that uses text similarity algorithms to compare student answers with model responses. The system assigns marks based on semantic similarity, generates detailed reports, and allows quick finalization. This approach improves fairness, accuracy, and efficiency, while reducing faculty workload and evaluation stress.

Empathy

•How often do you encounter technical issues with the current automated grading system?
• Rarely   • Sometimes   • Often   • Very Often

•How much time do you spend reviewing or correcting the automated grading results per day?
• Less than 30 minutes   • 30 minutes – 1 hour   • 1–2 hours   • More than 2 hours

•Have you ever noticed discrepancies between the system's grading and your own evaluation of a student's answer?
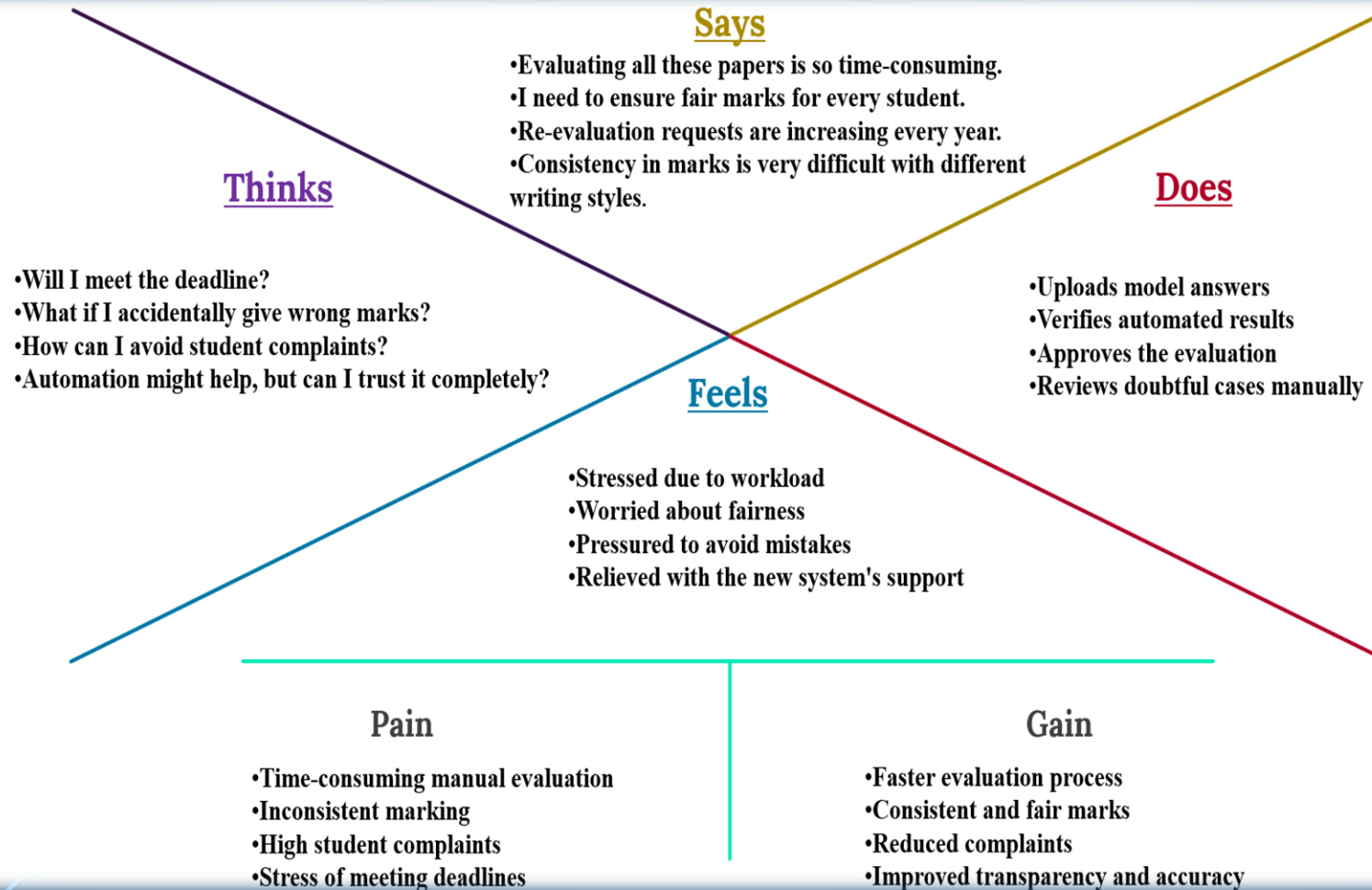• Yes   • No   • Not Sure

•What's your biggest challenge with the current system?
• Missing nuanced answers
• Lack of personalized feedback for students
• Time spent reviewing or correcting results
• Technical glitches or errors in the system

Empathy Map

User: Arun(Professor)

Says

- Evaluating all these papers is so time-consuming.
- I need to ensure fair marks for every student.
- Re-evaluation requests are increasing every year.
- Consistency in marks is very difficult with different writing styles.

Thinks

- Will I meet the deadline?
- What if I accidentally give wrong marks?
- How can I avoid student complaints?
- Automation might help, but can I trust it completely?

Does

- Uploads model answers
- Verifies automated results
- Approves the evaluation
- Reviews doubtful cases manually

Feels

- Stressed due to workload
- Worried about fairness
- Pressured to avoid mistakes
- Relieved with the new system's support

Pain

- Time-consuming manual evaluation
- Inconsistent marking
- High student complaints
- Stress of meeting deadlines

Gain

- Faster evaluation process
- Consistent and fair marks
- Reduced complaints
- Improved transparency and accuracy

Define the Problem Statement

The manual evaluation of semester-end theory exams at the college is time-consuming, inconsistent, and prone to human error, resulting in grading discrepancies, student dissatisfaction, and an increased number of re-evaluation requests. This places a significant burden on faculty members like Professor Ramesh and the examination department, highlighting the need for a more efficient, fair, and transparent evaluation process

User Persona

In Design Thinking, a user persona is a fictional, detailed representation of a typical user within your target audience. It is based on real user data, research, and insights, and helps teams keep user needs, goals, and pain points at the center of the design process.

Key Components of a User Persona:

- ✓ Name and Photo
- ✓ Demographics
- ✓ Background and Story
- ✓ Goals
- ✓ Pain Points
- ✓ Behaviors
- ✓ Needs and Expectations

User Persona

ARUN

Conditions I like to work in

I work best when I have clear evaluation criteria and sufficient time to review both the handwritten and uploaded answers carefully.

Times / hours I like to work

I work during allocated evaluation periods, preferably when I can focus without distractions.

Best ways to communicate with me

The best way to get your message across is by providing structured guidelines and well-defined rubrics.

Kind of feedback I need and how to deliver it

I respond best to constructive, detailed feedback that highlights both strengths and areas for improvement.

Things I need support with

I appreciate help with verifying unclear handwriting, detecting discrepancies between handwritten and uploaded responses, and ensuring fair grading.

How I learn best

The best way to teach me is by providing practical examples of evaluation methods and standard answer keys for reference.

Things I struggle with

I find it difficult when handwriting is illegible, responses are incomplete, or there is a mismatch between the uploaded and handwritten answers.

Things I love and enjoy

I love it when students present clear, well-structured answers that make evaluation easier.

Facts about me I'd like to share

I'm a meticulous evaluator who values accuracy, fairness, and clarity in the grading process.

Customer Journey Map

Customer Journey Mapping (CJM) is a visual representation of the stages and touchpoints a customer goes through when interacting with a brand. It outlines key phases like awareness, consideration, decision, and post-purchase, highlighting customer emotions, pain points, and opportunities for improvement.

Key Elements:
- ➢ **Customer Personas**: Different types of customers.
- ➢ **Stages**: The steps in the customer's journey
- ➢ **Touchpoints**: Interactions with the brand
- ➢ **Emotions and Pain Points**: Customer feelings and challenges.
- ➢ **Opportunities**: Areas for enhancing the customer experience.

Importance:
- ➢ Improves customer experience by identifying gaps and pain points.
- ➢ Aligns teams to focus on the customer's needs.
- ➢ Boosts conversion rates by streamlining the journey.

Customer Journey Map

Customer Journey Map

Phase 01
Submission

Touch Point 1

- Students submit handwritten copies physically or digitally.
- Digital answer scripts are uploaded to the evaluation portal.

Touch Point 2

- Initial verification of submissions to check for completeness and correctness.
- Ensuring both handwritten and uploaded copies match.

Phase 02
Initial Screening

Touch Point 1

- Checking for missing pages, unclear handwriting, or improper uploads.
- Identifying any discrepancies between the handwritten and digital versions.

Touch Point 2

- Sorting scripts for allocation to evaluators based on subject and complexity.

Phase 03
Detailed Evaluation

Touch Point 1

- Evaluators compare handwritten answers with uploaded copies.
- Grading based on predefined rubrics, marking schemes, and answer keys.

Touch Point 2

- Highlighting errors, partial marks, and additional comments for review.
- Identifying scripts needing further clarification due to unclear handwriting or ambiguous responses.

Phase 04
Review & Finalization

Touch Point 1

- Cross-checking marked responses for consistency and fairness.
- Moderation or re-evaluation if discrepancies arise.

Touch Point 2

- Final marks entry, report generation, and result.
- processing.Providing feedback or remarks before publishing results.

Ideate Phase

The **Ideate Phase** is a crucial stage in the design thinking or problem-solving process, where teams generate creative ideas and solutions to address the challenges identified during the earlier stages, such as **Empathy** and **Define**.

Key Aspects of the Ideate Phase:

1.**Goal**: To brainstorm a wide range of ideas without immediate concern for feasibility, aiming for creative and innovative solutions.
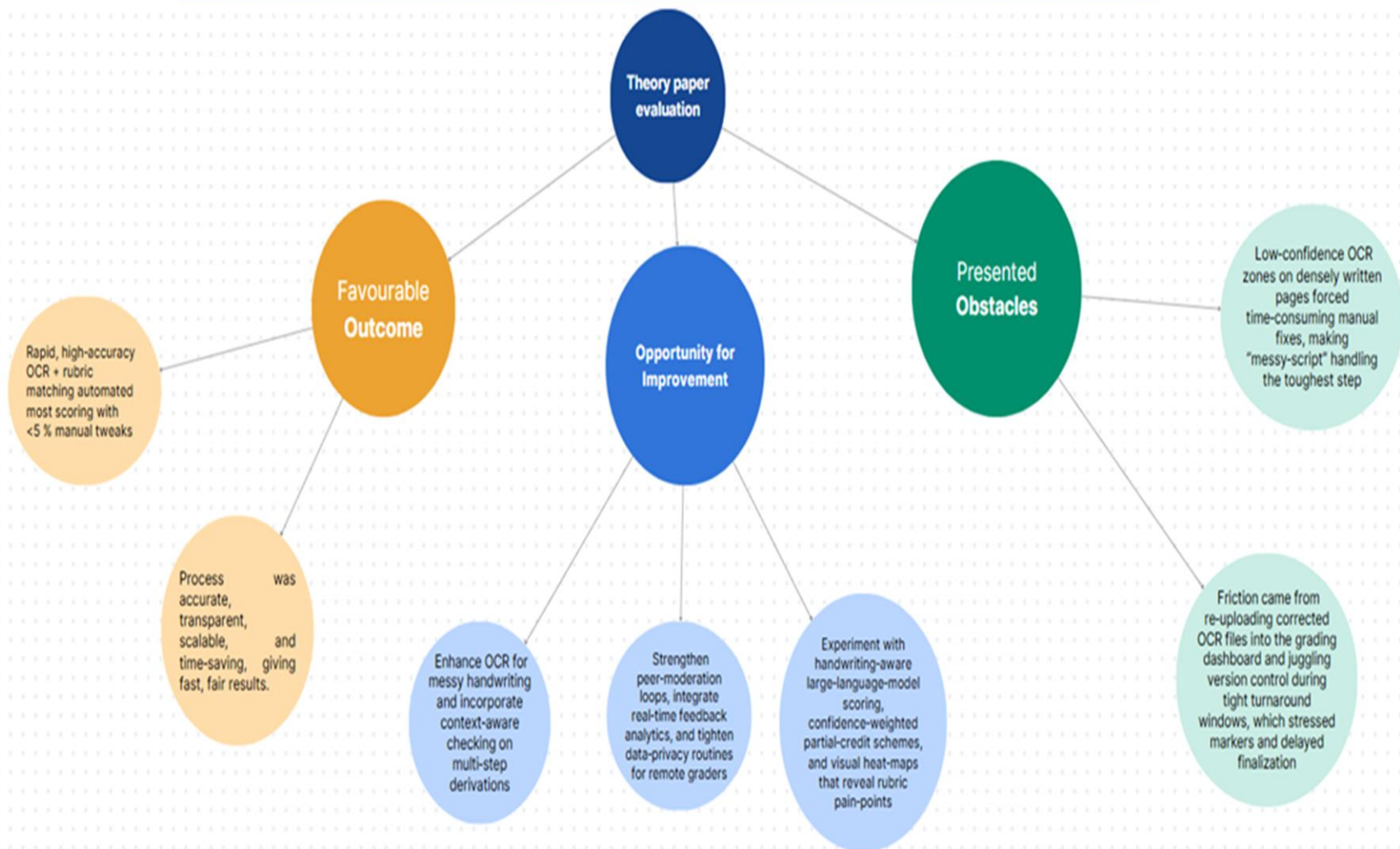
2.**Methods**:

1. **Brainstorming**: Encourage free thinking and the generation of multiple ideas, no matter how unconventional.
2. **Mind Mapping**: Visualize the relationships between ideas and concepts.
3. **SCAMPER**: A technique for enhancing existing ideas by asking questions like: "What can be substituted, combined, adapted, modified, put to another use, eliminated, or reversed?"
4. **Sketching or Prototyping**: Visual representation of ideas to clarify and develop them further.

3.**Divergence**: In this phase, the goal is to think broadly and consider as many different ideas as possible.

4.**Collaboration**: The ideate phase often involves diverse team members, encouraging interdisciplinary input to bring different perspectives.

5.**Evaluation**: While the ideate phase encourages free-flowing ideas, it's also important to start considering which ideas have the most potential for success in the next stages.

Brainstorm

Theory paper evaluation

Favourable Outcome

Rapid, high-accuracy OCR + rubric matching automated most scoring with <5 % manual tweaks

Process was accurate, transparent, scalable, and time-saving, giving fast, fair results.

Opportunity for Improvement

Enhance OCR for messy handwriting and incorporate context-aware checking on multi-step derivations

Strengthen peer-moderation loops, integrate real-time feedback analytics, and tighten data-privacy routines for remote graders

Experiment with handwriting-aware large-language-model scoring, confidence-weighted partial-credit schemes, and visual heat-maps that reveal rubric pain-points

Presented Obstacles

Low-confidence OCR zones on densely written pages forced time-consuming manual fixes, making "messy-script" handling the toughest step

Friction came from re-uploading corrected OCR files into the grading dashboard and juggling version control during tight turnaround windows, which stressed markers and delayed finalization

Tools and Specifications

Tools:
- ➢ **Frontend**: HTML, CSS, JavaScript (Bootstrap optional)
- ➢ **Backend**: Flask, Flask-OAuthlib/Authlib
- ➢ **OCR**: OCR.Space API
- ➢ **NLP**: scikit-learn (TF-IDF), spaCy, nltk
- ➢ **Excel Export**: openpyxl, pandas
- ➢ **Authentication**: Google, Facebook, Twitter Oauth

Features:
- ➢ Upload files & extract text with OCR.
- ➢ Compare extracted text with answer key (TF-IDF).
- ➢ Display and export results to Excel.
- ➢ OAuth authentication.

Architecture Diagram
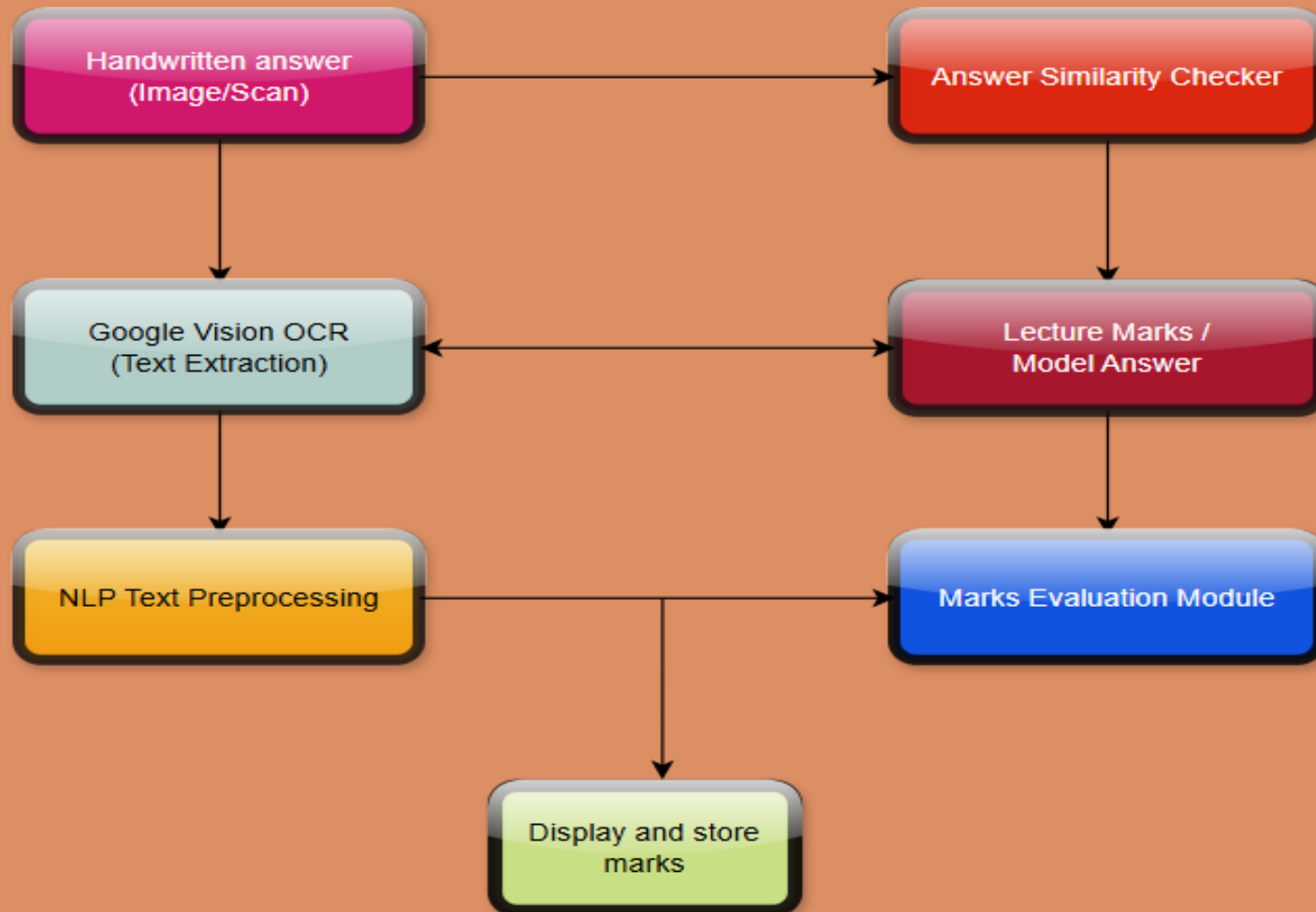
Prototype

SmartCheck

Student ID:

12345

User ID:

admin

Password:

....

Passkey:

......

Question PDF:

Choose File   questions.pdf

Question Image:

Choose File   No file chosen

Question HTML:

Choose File   No file chosen

Key Sheet PDF:

Choose File   key sheet.pdf

Key Sheet Image:

Choose File   No file chosen

Answer Sheet PDF:

Choose File   few correct.pdf

Answer Sheet Image:

Choose File   No file chosen

Weightage for Each Question (Comma-separated):

10,10,10,5

Upload

Upload successful!

	A	B	C	D
1	Student ID	Accuracy Score	Obtained Marks	
2	12345	42.85714286	15	
3				
4				
5				

Future Enhancement

➢ **Semantic Scoring**: Use BERT/Sentence Transformers for deep answer understanding.

➢ **Partial & Rubric Grading**: Award marks based on concept coverage and teacher-defined rubrics.

➢ **More File Formats**: Support DOCX, audio (speech-to-text), and advanced handwritten OCR.

➢ **Plagiarism Detection**: Check against web content and peer submissions.

➢ **Visualization Dashboard**: Graphical display of scores, keywords, and trends.

➢ **Role-Based Access**: Separate portals for Admin, Teacher, and Student.

➢ **Multi-language Support**: Evaluate answers in different languages via translation APIs.

➢ **Report Generation**: Export results as PDFs and Excel files.

➢ **Automated Feedback**: Highlight missing points and grammar issues automatically.

➢ **LMS Integration**: Connect with platforms like Google Classroom.

➢ **Mobile-Friendly/PWA**: Enable offline use and mobile responsiveness.

Contributions

Durga Prasad

- Designed and implemented OCR pipeline using Tesseract and PyMuPDF.
- Developed backend logic for key sheet and student answer extraction.
- Integrated TF-IDF algorithm for answer similarity comparison.
- Handled accuracy evaluation and Excel-based results export.

Rama Krishna

- Designed and developed the frontend using HTML, CSS, JavaScript.
- Enabled file upload interface and dynamic result display.
- Integrated frontend with Flask backend for seamless processing.
- Managed UI feedback, loading animations, and download options.

Tarun

- Defined project scope, user flow, and tool requirements.
- Drafted system architecture, module breakdown, and use cases.
- Coordinated team integration tasks and GitHub repository.
- Prepared final documentation and deployment setup.

Conclusion

This system effectively combines OCR, NLP, and machine learning to automate the evaluation of student responses by comparing them with reference materials. It uses Flask for backend processing, enabling seamless file uploads and accurate text extraction from various formats. By analyzing responses against key sheets and incorporating online sources for comparison, the system ensures precise, efficient, and scalable assessments. This technology-driven solution not only streamlines the grading process but also promotes fairness and consistency in evaluations, ultimately offering educators a more efficient alternative to traditional methods.