CHAPTER-9

APPENDICES

9.1 APPENDIX-A: SAMPLE SOURCE CODE

Main.py

```python
from django.http import HttpResponse
from django.shortcuts import get_object_or_404, render, redirect
from django.contrib.auth.models import User
from django.contrib.auth import login,authenticate,logout
from django.contrib.auth.decorators import login_required
from django.contrib import messages
from .models import EvaluationResult, ExamSubmission,Exam
from .evaluation.ocr import generate_ocr
from .evaluation.extract_question_answerkey import question_answer_content
from .evaluation.preprocess_ocr import preprocess_ocr_question_wise
from .evaluation.evalution import evaluate_exam_with_ocr_to_json
from .evaluation.report import generate_report
from.evaluation.proper_json import parse_json_string
import json


def home(request):
    return render(request, 'home.html')


def signup_view(request):
    if request.method == "POST":
        username = request.POST['username']
        email = request.POST['email']
        password1 = request.POST['password1']
        password2 = request.POST['password2']

        if password1 != password2:
            messages.error(request, "Passwords do not match!")
            return redirect('signup')

        if User.objects.filter(username=username).exists():
            messages.error(request, "Username already taken!")
            return redirect('signup')

        if User.objects.filter(email=email).exists():
            messages.error(request, "Email is already in use!")
            return redirect('signup')

        user = User.objects.create_user(username=username, email=email, 
password=password1)
        login(request, user)
        messages.success(request, "Account created successfully!")
        return redirect('login')

    return render(request, 'authentication/signup.html')

def login_view(request):
    if request.method == "POST":
        username = request.POST['username']
        password = request.POST['password']
        user = authenticate(request, username=username, password=password)

        if user is not None:
            login(request, user)
            messages.success(request, "Login successful!")
            return redirect('student_dashboard')
        else:
            messages.error(request, "Invalid username or password!")

    return render(request, 'authentication/login.html')


def student_dashboard(request):
    exams = ExamSubmission.objects.filter(student=request.user)  # Fetch exams 
created by logged-in student
    return render(request, 'dashboard/student/student_dashboard.html', {'exams': 
exams})

def logout_view(request):
    logout(request)
    messages.success(request, "Logged out successfully!")
    return redirect('login')

def student_exam_fill(request):
    if request.method == "POST":
        subject = request.POST.get("subject")
        exam_type = request.POST.get("exam_type")
        year = request.POST.get("year")
        staff_name = request.POST.get("staff_name")

        # Check if an exam exists with these details
        exam = Exam.objects.filter(year=year).first()

        if not exam:
            messages.error(request, "❌ No matching exam found. Please check the
details.")
            return redirect("student_exam_fill")  # Prevent saving if exam
doesn't exist

        # Create a new submission linked to this exam
        submission = ExamSubmission.objects.create(
            exam=exam,  # Assigning the required exam field
            student=request.user,
            subject=subject,
            exam_type=exam_type,
            year=year,
            staff_name=staff_name,
        )

        messages.success(request, "✅ Exam submission successful!")
        return redirect("student_dashboard")

    return render(request, "dashboard/student/exam_fill.html")

def teacher_login(request):
    if request.method == "POST":
        username = request.POST["username"]
        password = request.POST["password"]
        user = authenticate(request, username=username, password=password)

        if user is not None:
            if user.is_superuser:  # Allow only superusers
                login(request, user)
                messages.success(request, "Welcome, Teacher!")
                return redirect("teacher_dashboard")  # Redirect to teacher
dashboard
            else:
                messages.error(request, "Access Denied! Only teachers
(superusers) can log in.")
        else:
            messages.error(request, "Invalid Username or Password!")

    return render(request, "dashboard/teacher/teacher_login.html")

@login_required
def teacher_dashboard(request):
    if not request.user.is_superuser:
        return redirect("home")  # Redirect unauthorized users

    exams = Exam.objects.all().order_by("-id")  # Fetch all exams
    return render(request, "dashboard/teacher/teacher_dashboard.html", {"exams":
exams})

@login_required
def create_exam(request):
    if not request.user.is_superuser:
        messages.error(request, "❌ Unauthorized access!")
        return redirect("home")

    if request.method == "POST":
        subject = request.POST.get("subject")
        exam_type = request.POST.get("exam_type")
        year = request.POST.get("year")
        staff_name = request.POST.get("staff_name")
        question_paper = request.FILES.get("question_paper")
        answer_key = request.FILES.get("answer_key")

        if not all([subject, exam_type, year, staff_name, question_paper,
answer_key]):
            messages.error(request, "⚠ All fields are required!")
            return redirect("create_exam")

        Exam.objects.create(
            subject=subject,
            exam_type=exam_type,
            year=year,
            staff_name=staff_name,
            question_paper=question_paper,
            answer_key=answer_key
        )

        messages.success(request, "✅ Exam successfully created!")
        return redirect("teacher_dashboard")

    return render(request, "dashboard/teacher/create_exam.html")

@login_required
def view_submissions(request, exam_id):
    exam = get_object_or_404(Exam, id=exam_id)
    submissions = ExamSubmission.objects.filter(year=exam.year)
    if request.method == "POST":
        for submission in submissions:
            file_field_name = f"answer_sheet_{submission.id}"
            if file_field_name in request.FILES:
                if submission.answer_sheet:
                    messages.warning(request, f"⚠ Answer sheet for
{submission.student.username} already uploaded.")
                else:
                    submission.answer_sheet = request.FILES[file_field_name]
                    submission.save()
                    messages.success(request, f"✅ Answer sheet uploaded for
{submission.student.username}.")

        return redirect('view_submissions', exam_id=exam.id)

    return render(request, "dashboard/teacher/view_submissions.html", {"exam":
exam, "submissions": submissions})


def evaluate_submission_view(request, submission_id):
    submission = get_object_or_404(ExamSubmission, id=submission_id)

    # 🔍 Check if the submission is already evaluated
    evaluation = EvaluationResult.objects.filter(submission=submission).first()

    if evaluation:
        messages.info(request, "This submission has already been evaluated.")
        formatted_report = parse_json_string(evaluation.formatted_report)

        total_score = evaluation.total_score
        max_score = evaluation.max_score
    else:
        #OCR text from uploaded answer sheet
        ocr_text = generate_ocr(submission.answer_sheet.path)

        # Extract question paper and answer key
        question_paper_text =
question_answer_content(submission.exam.question_paper.path)
        answer_key_text =
question_answer_content(submission.exam.answer_key.path)

        # Preprocess OCR text to align with question numbers
        structured_ocr_text = preprocess_ocr_question_wise(ocr_text,
question_paper_text)
```

```
        # Evaluate answers using Gemini API
        evaluation_result_json =
evaluate_exam_with_ocr_to_json(structured_ocr_text, answer_key_text)

        formatted_report = generate_report(evaluation_result_json)
        formatted_report = parse_json_string(formatted_report)
        print(formatted_report)
        total_score = formatted_report["summary"]["user_total_score"]
        max_score =  formatted_report["summary"]["total_possible_score"]

        # Save the evaluation result in the database
        evaluation = EvaluationResult.objects.create(
            submission=submission,
            evaluated_by=request.user,
            formatted_report=json.dumps(formatted_report),
            total_score=total_score,
            max_score=max_score,
        )
        submission.is_graded = True
        submission.save()

        messages.success(request, "Evaluation completed successfully!")

    # Render the evaluation results page
    return render(request, 'dashboard/teacher/evaluate_submission.html', {
        'submission': submission,
        'formatted_report': formatted_report,
        'total_score': total_score,
        'max_score': max_score
    })


def view_results(request,exam_id):
    submission = get_object_or_404(ExamSubmission, id=exam_id)

    # Check if the submission is already evaluated
    evaluation = EvaluationResult.objects.filter(submission=submission).first()

    if evaluation:
        messages.info(request, "This submission has already been evaluated.")
        formatted_report = parse_json_string(evaluation.formatted_report)

        total_score = evaluation.total_score
        max_score = evaluation.max_score
    return render(request, 'dashboard/teacher/evaluate_submission.html', {
        'submission': submission,
        'formatted_report': formatted_report,
        'total_score': total_score,
        'max_score': max_score
    })
```

Urls.py

```

from django.contrib import admin
from django.urls import path
from app import views
from django.conf import settings
from django.conf.urls.static import static

urlpatterns = [
    path("admin/", admin.site.urls),
    path('', views.home, name='home'),
    path('signup/', views.signup_view, name='signup'),
    path('login/', views.login_view, name='login'),
    path('logout/', views.logout_view, name='logout'),
    path('student_dashboard/', views.student_dashboard,
name='student_dashboard'),
    path('view-results/<int:exam_id>/', views.view_results, name='view_results'),
    path('student_exam_fill/', views.student_exam_fill,
name='student_exam_fill'),
    path('teacher-login/', views.teacher_login, name='teacher_login'),
    path('teacher-dashboard/', views.teacher_dashboard,
name='teacher_dashboard'),
    path('create-exam/', views.create_exam, name='create_exam'),
    path('view-submissions/<int:exam_id>/', views.view_submissions,
name='view_submissions'),
    path('evaluate/<int:submission_id>/', views.evaluate_submission_view,
name='evaluate_submission'),
]+ static(settings.MEDIA_URL,document_root=settings.MEDIA_ROOT)

urlpatterns+= static(settings.STATIC_URL,document_root=settings.STATIC_ROOT)
```

Models.py

```
from django.db import models
from django.contrib.auth.models import User


class Exam(models.Model):
    YEAR_CHOICES = [
        (1, "First Year"),
        (2, "Second Year"),
        (3, "Third Year"),
        (4, "Fourth Year"),
    ]

    EXAM_TYPE_CHOICES = [
        ("CAT1", "CAT 1"),
        ("CAT2", "CAT 2"),
    ]

    subject = models.CharField(max_length=255)
    exam_type = models.CharField(max_length=4, choices=EXAM_TYPE_CHOICES,
default="CAT1")
    year = models.IntegerField(choices=YEAR_CHOICES)
    staff_name = models.CharField(max_length=255)
    question_paper = models.FileField(upload_to='question_papers/')
    answer_key = models.FileField(upload_to='answer_keys/')
    created_at = models.DateTimeField(auto_now_add=True)

    def __str__(self):
        return f"{self.subject} - {dict(self.YEAR_CHOICES).get(self.year,
'Unknown')} - {self.get_exam_type_display()}"


class ExamSubmission(models.Model):
    EXAM_TYPES = [
        ('CAT1', 'CAT 1'),
        ('CAT2', 'CAT 2'),
    ]

    YEARS = [
        (1, "First Year"),
        (2, "Second Year"),
        (3, "Third Year"),
        (4, "Fourth Year"),
    ]

    exam = models.ForeignKey(Exam, on_delete=models.CASCADE)  # Remove null=True,
blank=True
    student = models.ForeignKey(User, on_delete=models.CASCADE)
    subject = models.CharField(max_length=100)
    exam_type = models.CharField(max_length=10, choices=EXAM_TYPES)
    year = models.CharField(max_length=1, choices=YEARS)
    staff_name = models.CharField(max_length=100)
    answer_sheet = models.FileField(upload_to='answer_sheets/', null=True,
blank=True)
    is_graded = models.BooleanField(default=False)

    def __str__(self):
        return f"{self.subject} - {self.exam_type} ({self.get_year_display()})"


class EvaluationResult(models.Model):
    submission = models.OneToOneField(
        ExamSubmission,
        on_delete=models.CASCADE,
        related_name="evaluation"
    )
    evaluated_by = models.ForeignKey(
        User,
        on_delete=models.SET_NULL,
        null=True,
        blank=True,
        related_name="evaluations"
    )
    formatted_report = models.TextField()  # Stores only the human-readable
report
    total_score = models.FloatField(default=0.0)
    max_score = models.FloatField(default=0.0)
    created_at = models.DateTimeField(auto_now_add=True)

    def __str__(self):
        exam_subject = self.submission.exam.subject if self.submission.exam else
"Unknown Exam"
        return f"Evaluation for {self.submission.student.username}
{exam_subject}"
```

admin.py

```python
from django.contrib import admin
from .models import EvaluationResult,Exam

admin.site.register(EvaluationResult)

admin.site.register(Exam)
```

Student-dashboard.html

```html
{% extends 'base.html' %}

{% block content %}
<div class="container mt-5">
    <div class="card shadow-lg p-4">
        <h2 class="text-center text-primary fw-bold">🎓 Welcome, {{
request.user.username }}!</h2>
        <hr>

        <div class="d-flex justify-content-between align-items-center mb-4">
            <h3 class="text-secondary fw-semibold">📄 Your Submitted Exams</h3>
            <a href="{% url 'student_exam_fill' %}" class="btn btn-success btn-lg
shadow-sm">
                + Fill Exam Details
            </a>
        </div>

        {% if exams %}
        <div class="table-responsive">
            <table class="table table-hover table-bordered text-center align-
middle">
                <thead class="table-dark">
                    <tr>
                        <th>📚 Subject</th>
                        <th>📝 Exam Type</th>
                        <th>🎓 Year</th>
                        <th>👨‍🏫 Staff Name</th>
                        <th>📊 Status</th>
                        <th>🔍 Actions</th>
                    </tr>
                </thead>
                <tbody>
```

```
                    {% for exam in exams %}
                    <tr>
                        <td class="fw-bold">{{ exam.subject }}</td>
                        <td>{{ exam.get_exam_type_display }}</td>
                        <td>{{ exam.get_year_display }}</td>
                        <td>{{ exam.staff_name }}</td>
                        <td>
                            {% if exam.is_graded %}
                                <span class="badge bg-success px-3 py-
2">Graded</span>
                            {% else %}
                                <span class="badge bg-warning text-dark px-3 py-
2">Pending</span>
                            {% endif %}
                        </td>
                        <td>
                            {% if exam.is_graded %}
                                <a href="{% url 'view_results' exam.id %}"
class="btn btn-primary btn-sm shadow-sm">
                                    View Results
                                </a>
                            {% else %}
                                <button class="btn btn-secondary btn-sm shadow-
sm" disabled>Awaiting Grading</button>
                            {% endif %}
                        </td>
                    </tr>
                    {% endfor %}
                </tbody>
            </table>
        </div>
        {% else %}
        <div class="alert alert-info text-center">
            <p class="mb-0">🚀 No exams submitted yet. Start by filling out your
first exam!</p>
        </div>
        {% endif %}

        <div class="text-center mt-4">
            <a href="{% url 'logout' %}" class="btn btn-danger btn-lg px-4
shadow-sm">🚪 Logout</a>
        </div>
    </div>
</div>
```

```
<style>
    body {
        background-color: #f8f9fa;
    }
    .card {
        border-radius: 12px;
        border: none;
        box-shadow: 0 4px 10px rgba(0, 0, 0, 0.1);
    }
    .table th {
        background-color: #212529;
        color: white;
    }
    .table td {
        vertical-align: middle;
    }
    .btn {
        border-radius: 8px;
    }
    .btn-success {
        background-color: #28a745;
    }
</style>
{% endblock %}
```

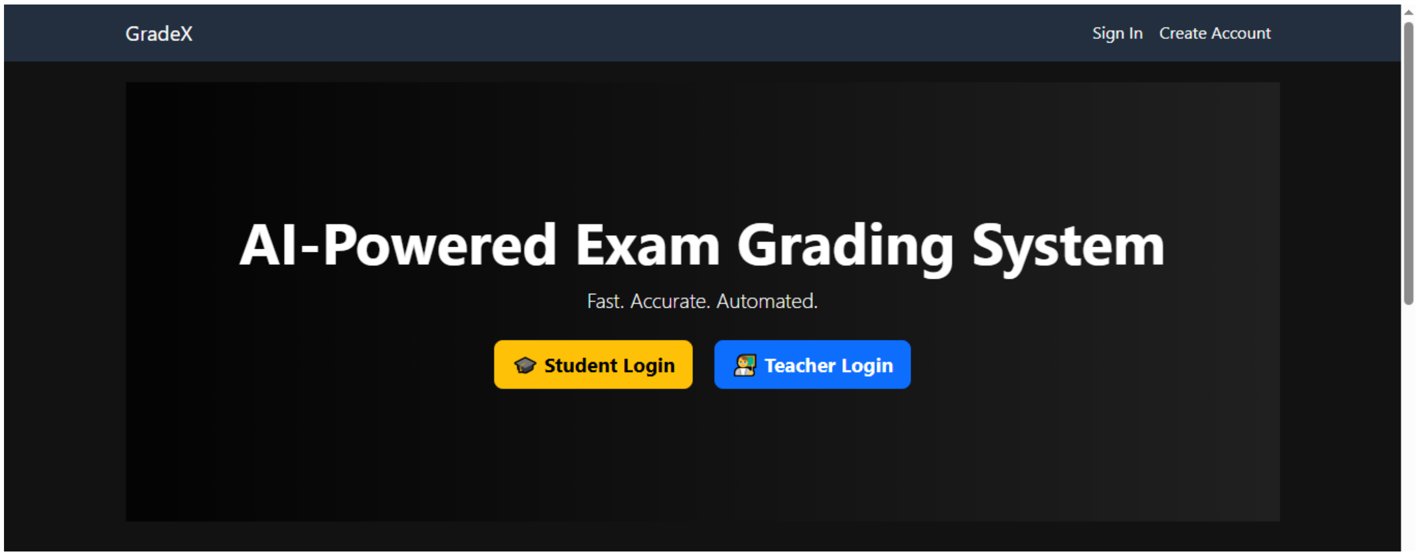
Teacher-dashboard.html

```
{% extends 'base.html' %}

{% block content %}
<div class="container-fluid">
    <div class="row">
        <!-- Sidebar -->
        <nav class="col-md-3 col-lg-2 d-md-block bg-dark sidebar vh-100 p-3">
            <h4 class="text-white text-center">📚 Teacher Panel</h4>
            <hr class="text-white">
            <ul class="nav flex-column">
                <li class="nav-item">
                    <a class="nav-link text-white" href="{% url
'teacher_dashboard' %}"> Dashboard</a>
                </li>
                <li class="nav-item">
                    <a class="nav-link text-white" href="{% url 'create_exam'
%}">✏️ Create Exam</a>
```

```
                </li>
                <li class="nav-item">
                    <a class="nav-link text-white" href="{% url 'logout' %}">
Logout</a>
                </li>
            </ul>
        </nav>

        <!-- Main Content -->
        <main class="col-md-9 ms-sm-auto col-lg-10 px-md-4 mt-4">
            <div class="d-flex justify-content-between align-items-center">
                <h2 class="text-primary">👨‍🏫 Welcome, {{ request.user.username
}}</h2>
                <a href="{% url 'create_exam' %}" class="btn btn-success btn-lg
shadow-sm">
                    + Create Exam
                </a>
            </div>
            <hr>

            <h3 class="text-secondary">📄 Created Exams</h3>
            {% if exams %}
                <div class="table-responsive">
                    <table class="table table-hover table-bordered text-center">
                        <thead class="table-dark">
                            <tr>
                                <th>Subject</th>
                                <th>Exam Type</th>
                                <th>Year</th>
                                <th>Actions</th>
                            </tr>
                        </thead>
                        <tbody>
                            {% for exam in exams %}
                                <tr>
                                    <td class="fw-bold">{{ exam.subject }}</td>
                                    <td>{{ exam.get_exam_type_display }}</td>
                                    <td>{{ exam.get_year_display }}</td>
                                    <td>
  <a href="{% url 'view_submissions' exam.id %}" class="btn btn-primary btn-sm">
                                            📂 View Submissions
                                        </a>
                                    </td>
                                </tr>
                            {% endfor %}
                        </tbody>
                    </table>
                </div>
            {% else %}
                <div class="alert alert-info text-center">
                    <p class="mb-0">No exams created yet.</p>
                </div>
            {% endif %}
        </main>
    </div>
</div>

<style>
    /* Sidebar Styling */
    .sidebar {
        height: 100vh;
        position: fixed;
        left: 0;
        top: 0;
        width: 250px;
    }

    /* Adjust main content */
    main {
        margin-left: 260px;
    }

    /* Button Styling */
    .btn-sm {
        font-size: 0.9rem;
    }

    /* Responsive Design */
    @media (max-width: 768px) {
        .sidebar {
            position: relative;
            height: auto;
            width: 100%;
        }
        main {
            margin-left: 0;
        }
    }
</style>
{% endblock %}
```

[redacted]

9.2 APPENDIX-B: DEMO SCREENSHOTS



GradeX

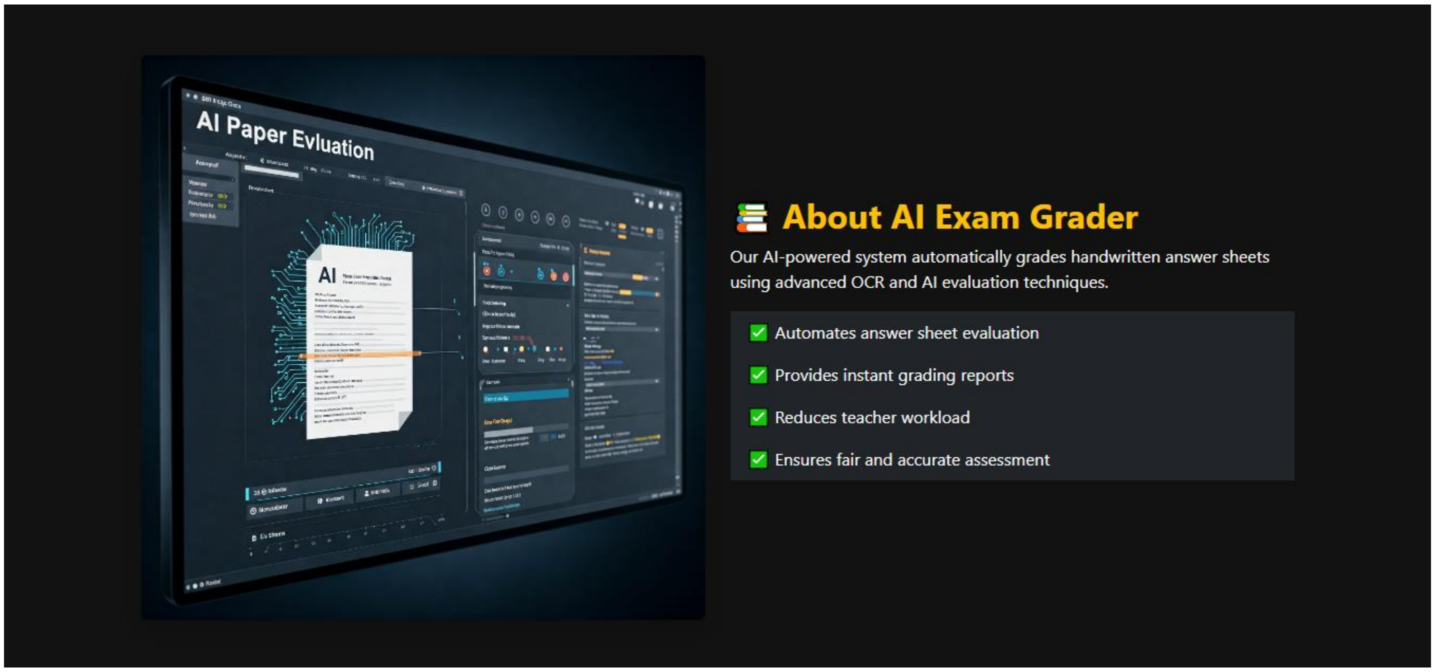
Sign In Create Account

AI-Powered Exam Grading System

Fast. Accurate. Automated.

Student Login Teacher Login

Fig: 9.1 GradeX Website



About AI Exam Grader

Our AI-powered system automatically grades handwritten answer sheets using advanced OCR and AI evaluation techniques.

- ✓ Automates answer sheet evaluation
- ✓ Provides instant grading reports
- ✓ Reduces teacher workload
- ✓ Ensures fair and accurate assessment

Fig: 9.2 GradeX Information

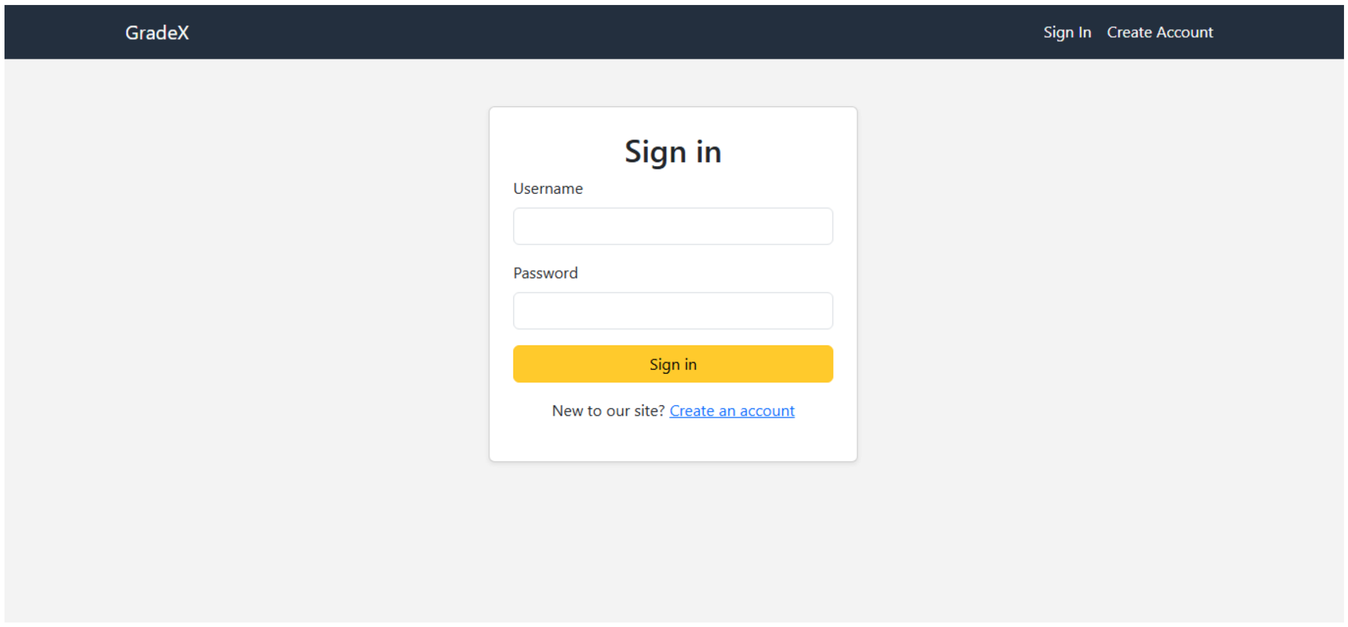


Fig: 9.3 Gradex Student Signin

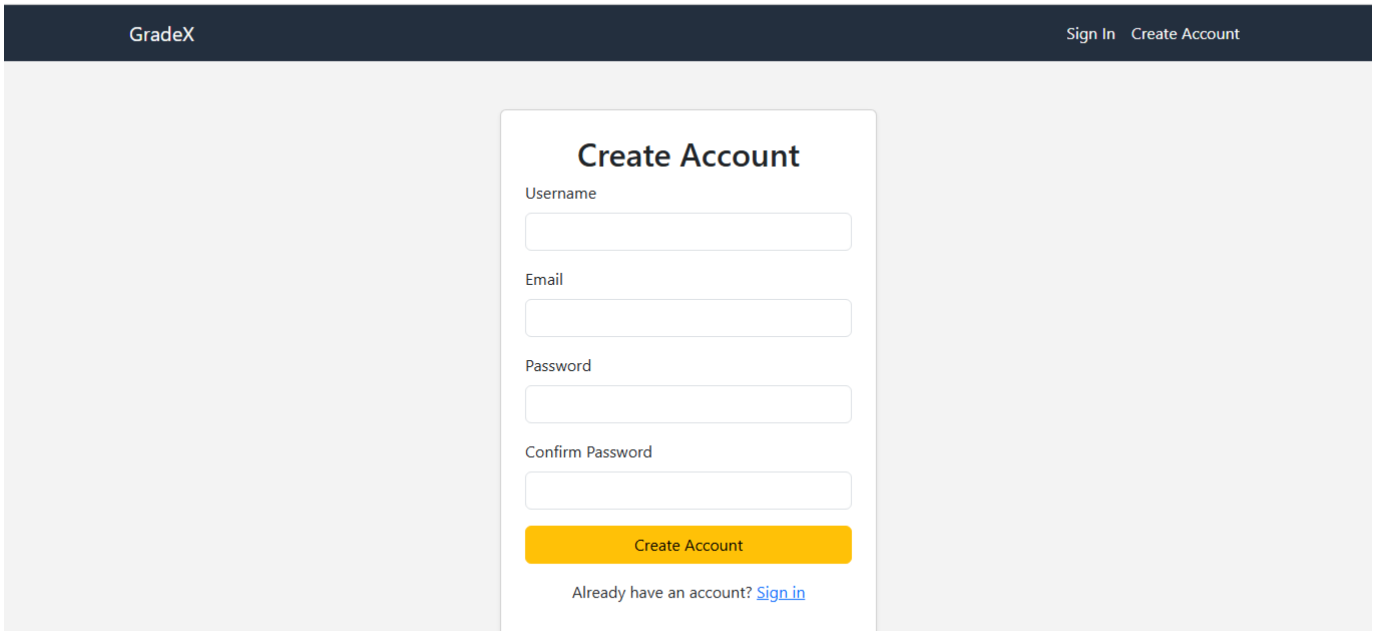
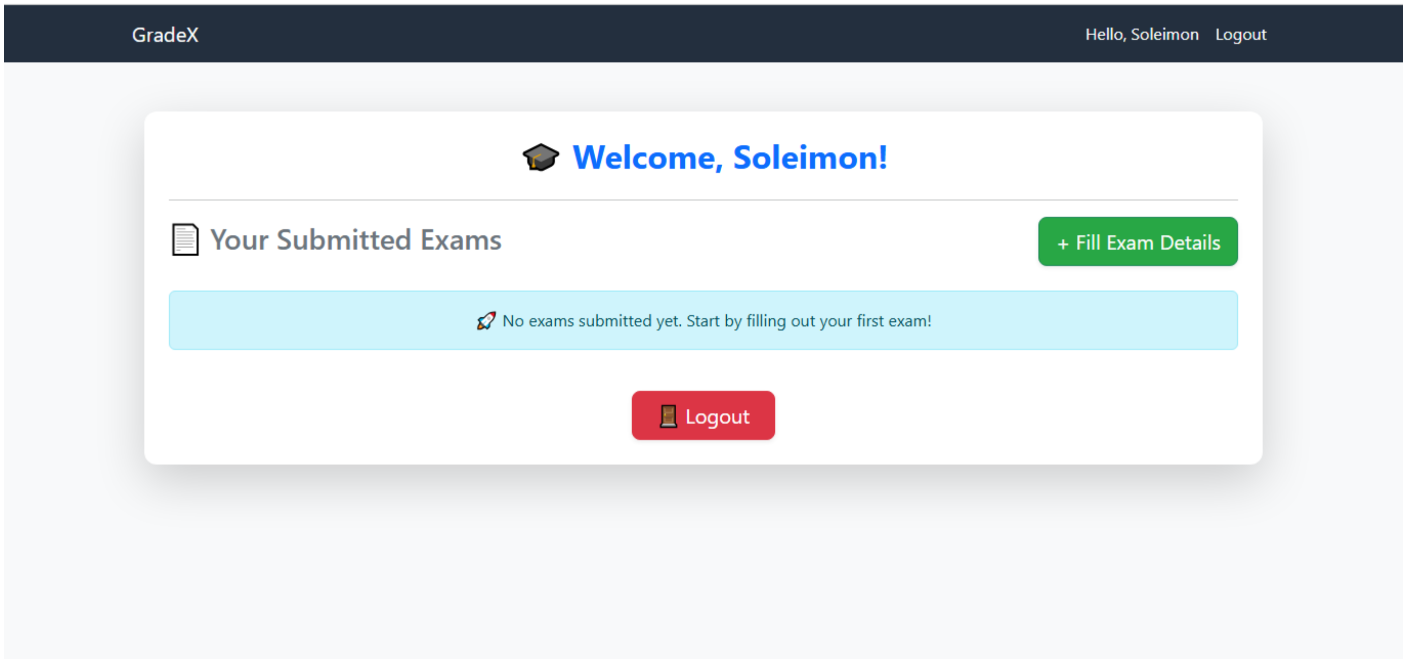


Fig: 9.4 Gradex Student Sign up


GradeX

Hello, Soleimon Logout

Welcome, Soleimon!

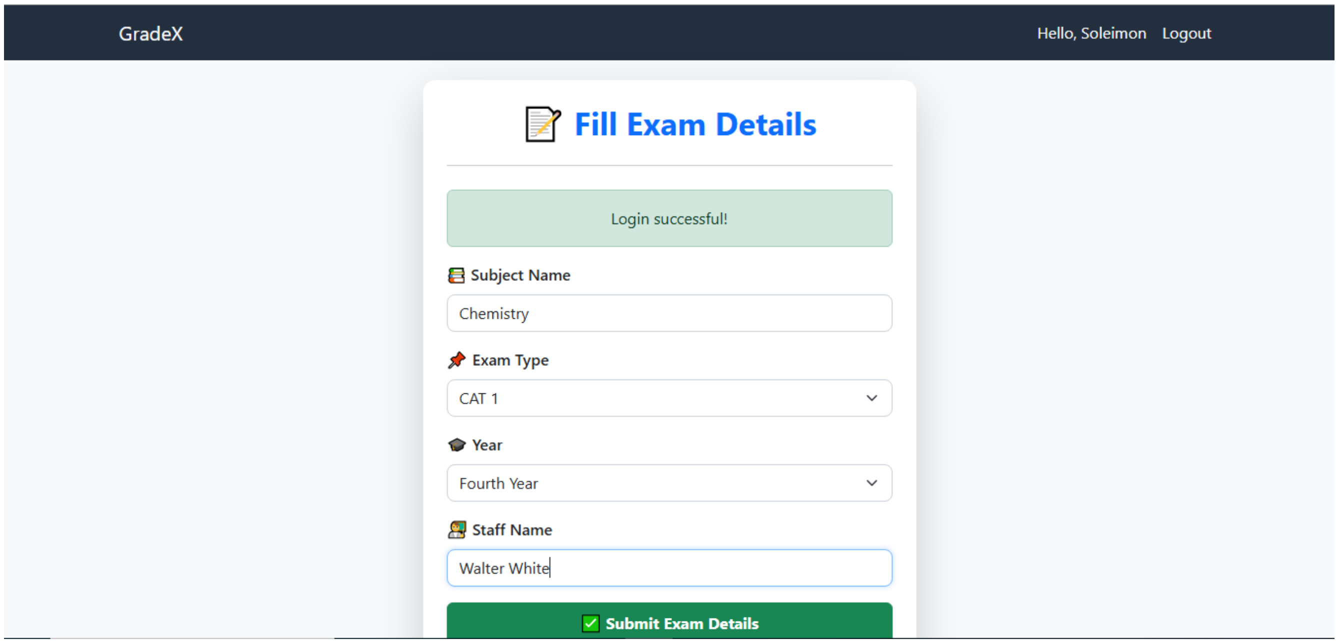
Your Submitted Exams

+ Fill Exam Details

No exams submitted yet. Start by filling out your first exam!

Logout

Fig: 9.5 Gradex Student Dashboard


GradeX

Hello, Soleimon Logout

Fill Exam Details

Login successful!

Subject Name: Chemistry

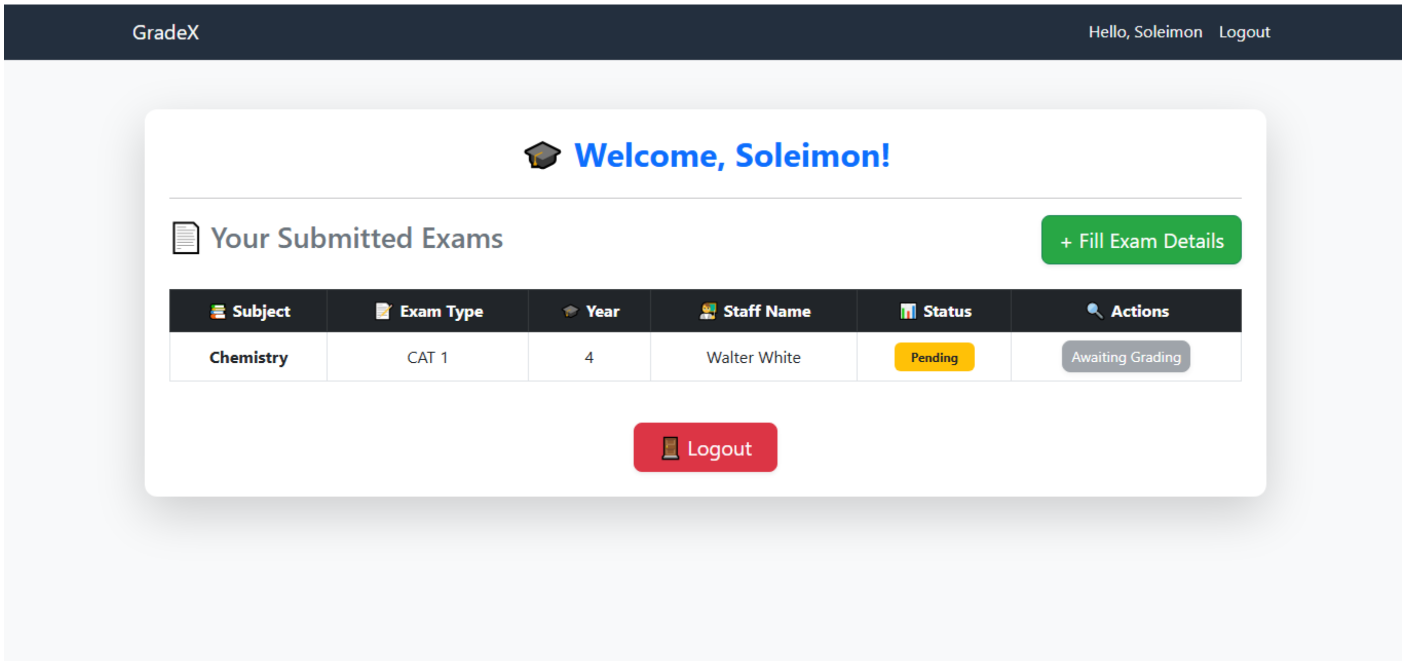
Exam Type: CAT 1

Year: Fourth Year

Staff Name: Walter White

Submit Exam Details

Fig: 9.6 Gradex Student Exam Fill


GradeX

Hello, Soleimon Logout

Welcome, Soleimon!

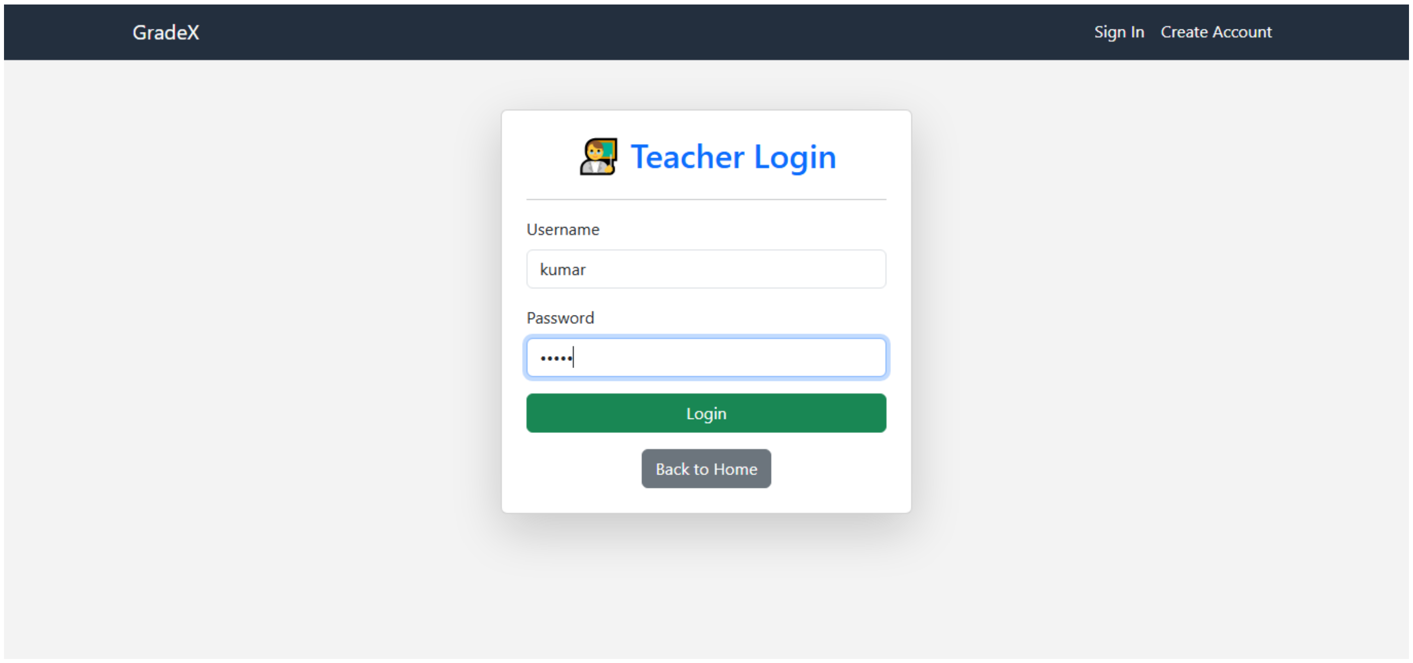
Your Submitted Exams

+ Fill Exam Details

Subject	Exam Type	Year	Staff Name	Status	Actions
Chemistry	CAT 1	4	Walter White	Pending	Awaiting Grading

Logout

Fig: 9.7 Gradex Student Awaiting Exam Status


GradeX

Sign In Create Account

Teacher Login

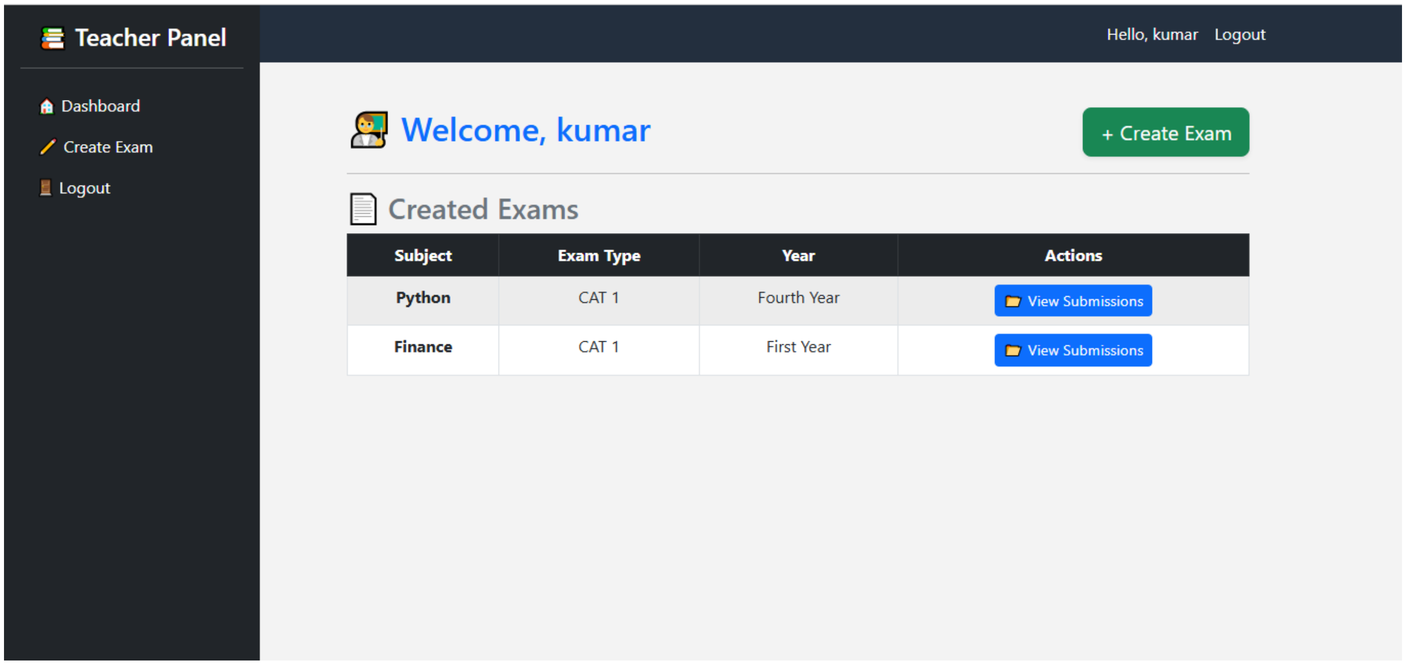
Username: kumar

Password: •••••

Login

Back to Home

Fig: 9.8 Gradex Teacher Login


Teacher Panel

Hello, kumar Logout

Dashboard

Create Exam

Logout

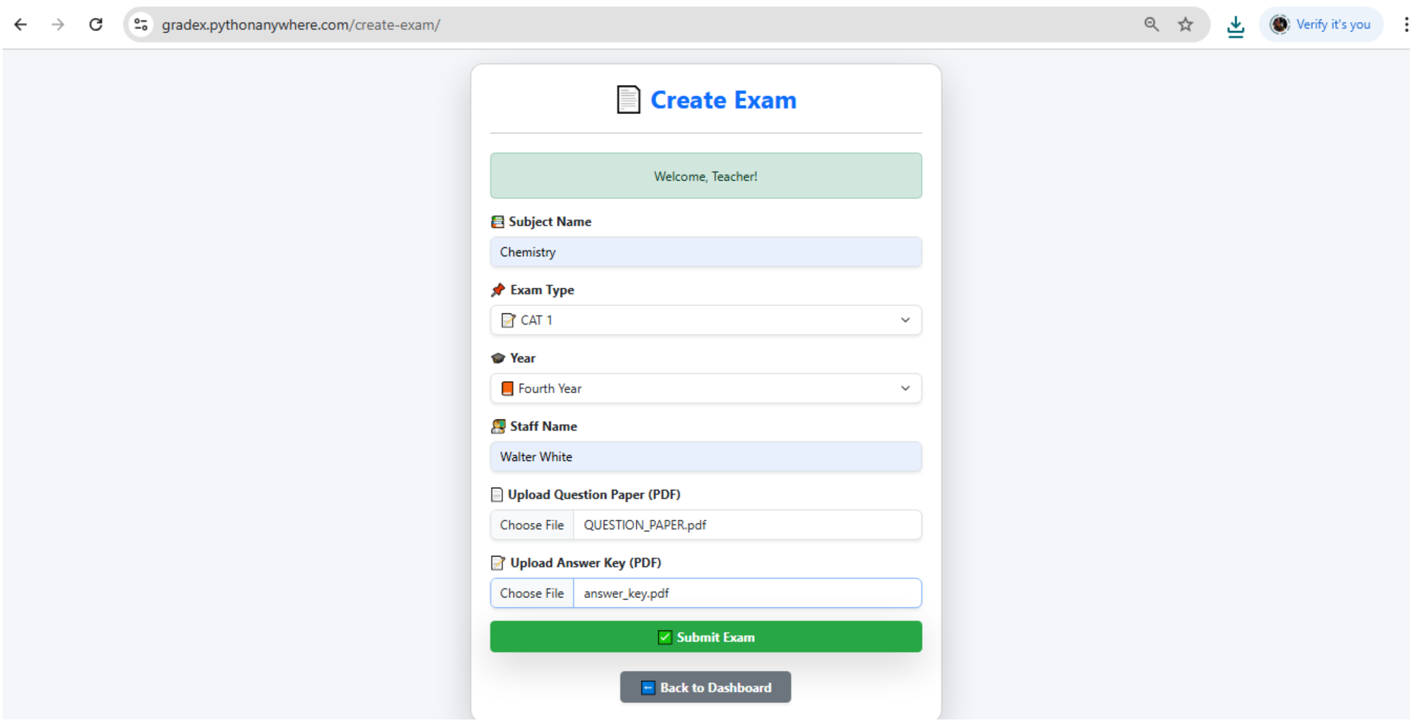
Welcome, kumar

+ Create Exam

Created Exams

Subject	Exam Type	Year	Actions
Python	CAT 1	Fourth Year	View Submissions
Finance	CAT 1	First Year	View Submissions

Fig: 9.9 Gradex Teacher Dashboard


gradex.pythonanywhere.com/create-exam/

Create Exam

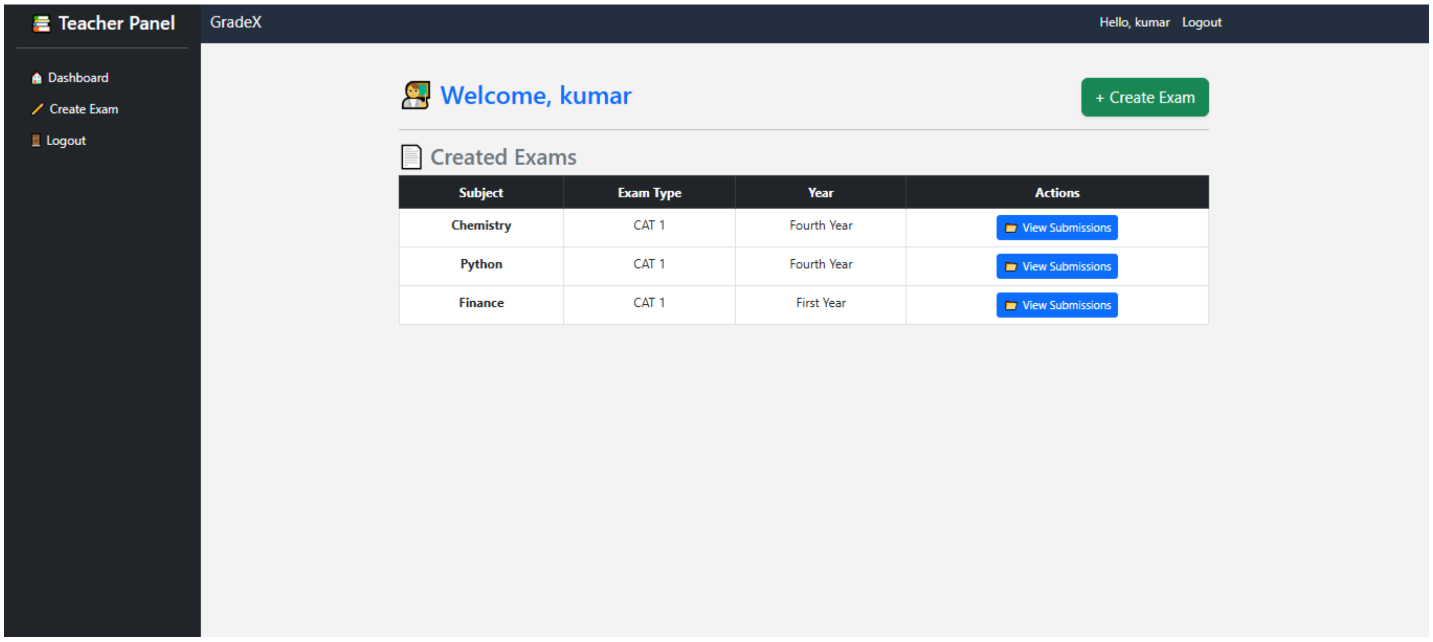
Welcome, Teacher!

Subject Name	Chemistry
Exam Type	CAT 1
Year	Fourth Year
Staff Name	Walter White
Upload Question Paper (PDF)	Choose File QUESTION_PAPER.pdf
Upload Answer Key (PDF)	Choose File answer_key.pdf

Submit Exam

Back to Dashboard

Fig: 9.10 Gradex Teacher Exam Creation

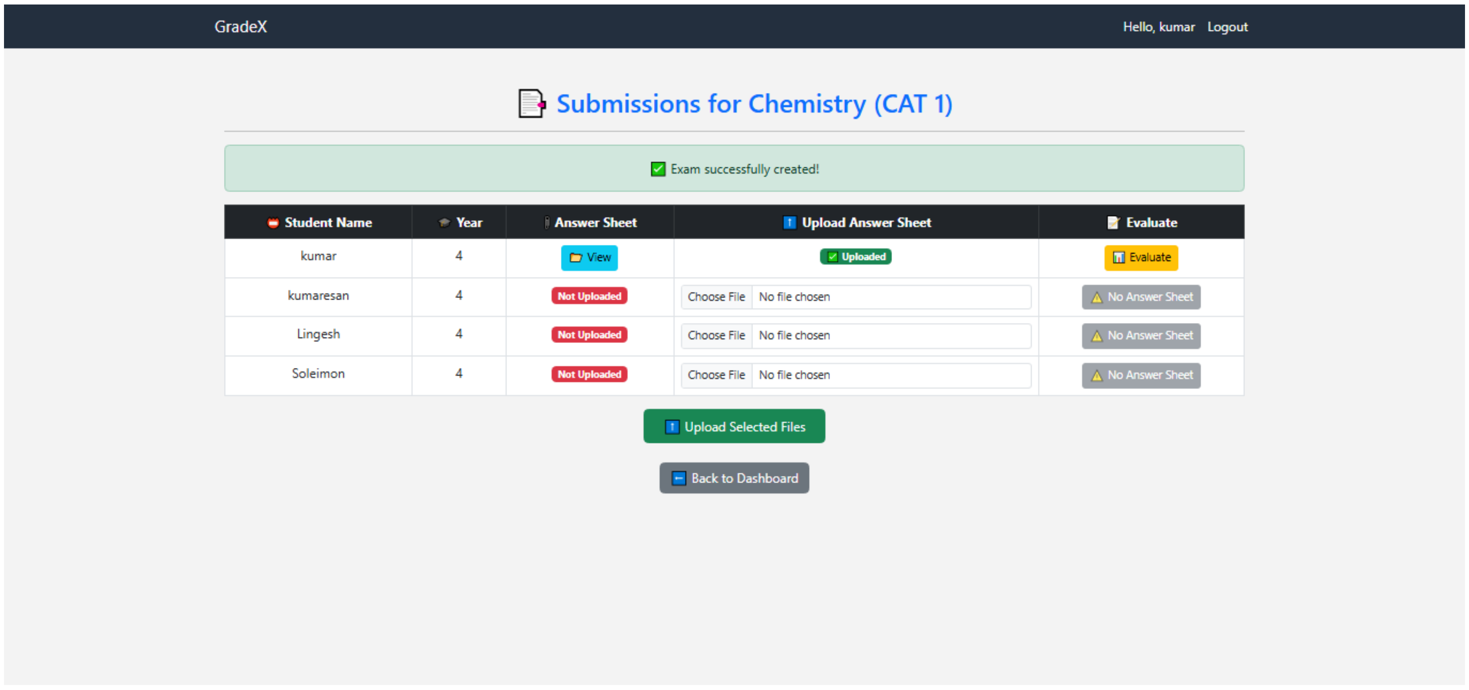


Welcome, kumar

Created Exams

Subject	Exam Type	Year	Actions
Chemistry	CAT 1	Fourth Year	View Submissions
Python	CAT 1	Fourth Year	View Submissions
Finance	CAT 1	First Year	View Submissions

Fig: 9.11 Gradex Teacher Dashboard-Created Exams

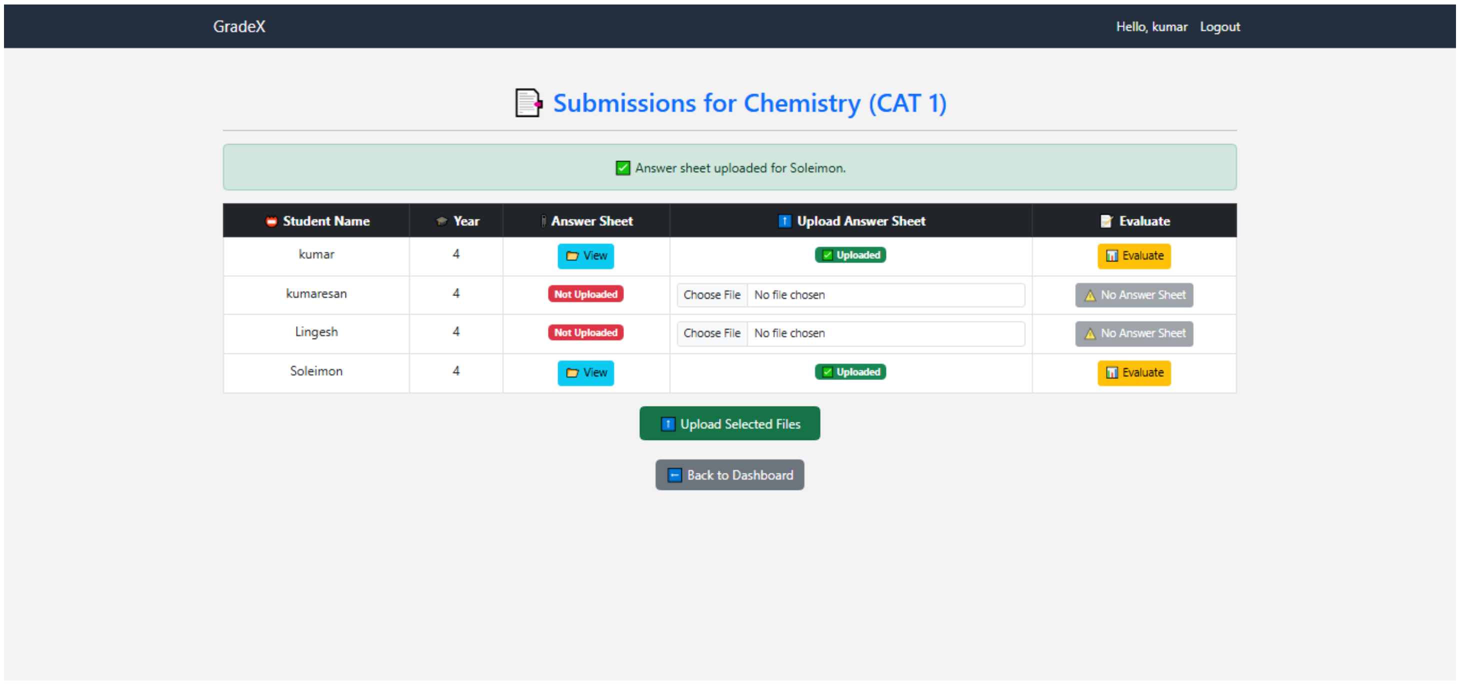


Submissions for Chemistry (CAT 1)

✅ Exam successfully created!

Student Name	Year	Answer Sheet	Upload Answer Sheet	Evaluate
kumar	4	View	Uploaded	Evaluate
kumaresan	4	Not Uploaded	Choose File No file chosen	No Answer Sheet
Lingesh	4	Not Uploaded	Choose File No file chosen	No Answer Sheet
Soleimon	4	Not Uploaded	Choose File No file chosen	No Answer Sheet

Fig: 9.12 Gradex Teacher Dashboard-Exam Submissin List



GradeX   Hello, kumar Logout

Submissions for Chemistry (CAT 1)

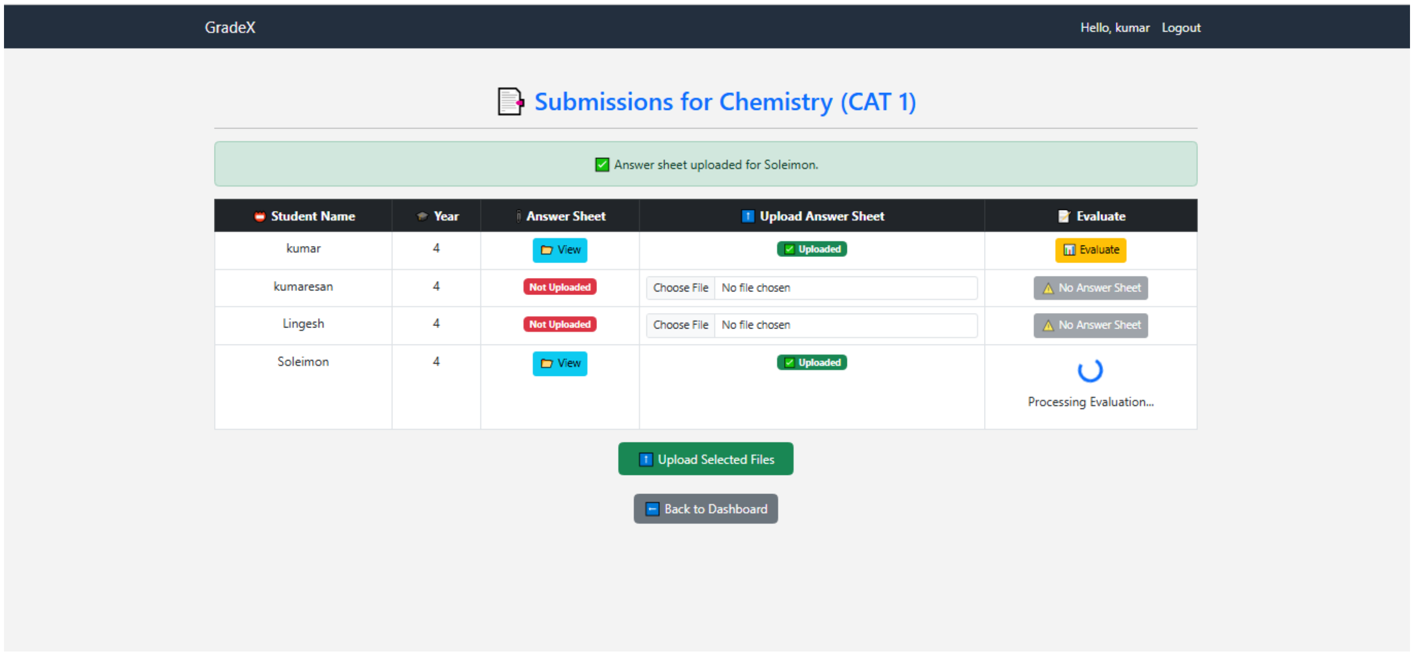
✓ Answer sheet uploaded for Soleimon.

Student Name	Year	Answer Sheet	Upload Answer Sheet	Evaluate
kumar	4	View	Uploaded	Evaluate
kumaresan	4	Not Uploaded	Choose File No file chosen	No Answer Sheet
Lingesh	4	Not Uploaded	Choose File No file chosen	No Answer Sheet
Soleimon	4	View	Uploaded	Evaluate

Upload Selected Files

Back to Dashboard

Fig: 9.13 Gradex Teacher Dashboard-Answer Sheet Upload



GradeX   Hello, kumar Logout

Submissions for Chemistry (CAT 1)

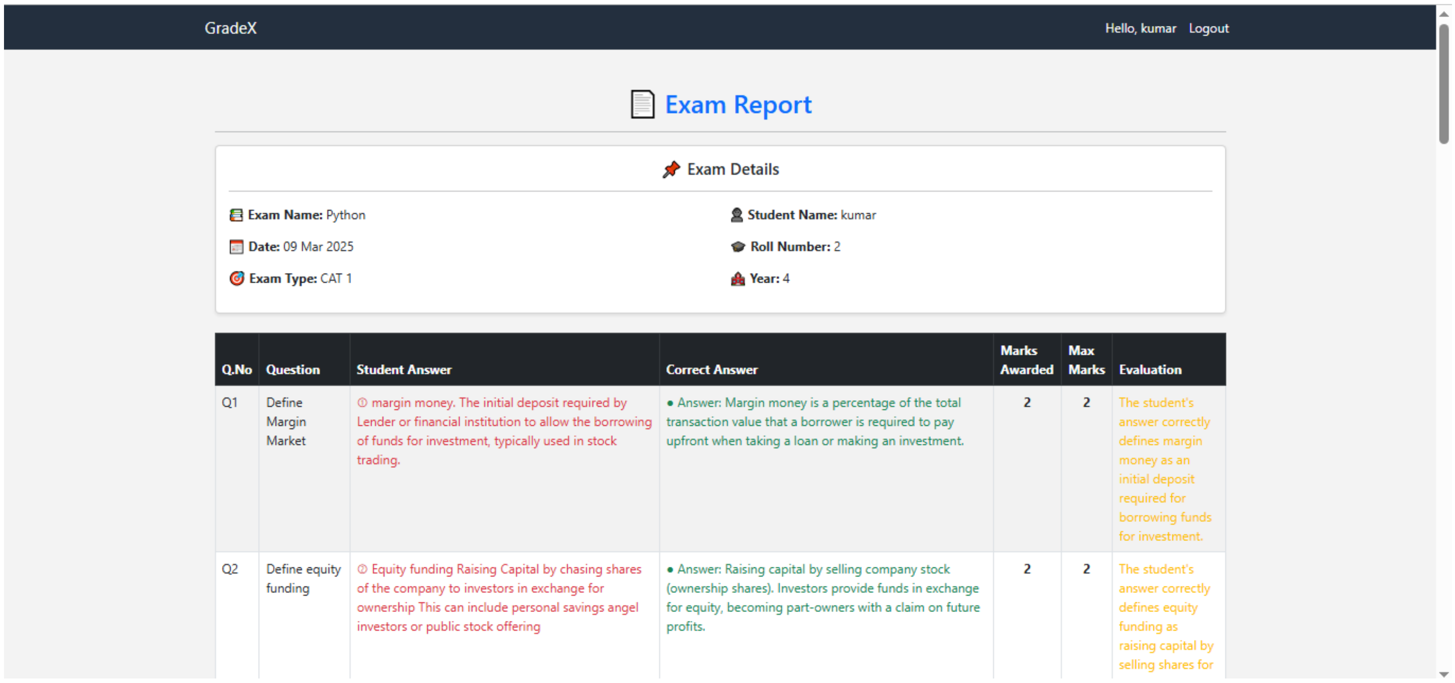
✓ Answer sheet uploaded for Soleimon.

Student Name	Year	Answer Sheet	Upload Answer Sheet	Evaluate
kumar	4	View	Uploaded	Evaluate
kumaresan	4	Not Uploaded	Choose File No file chosen	No Answer Sheet
Lingesh	4	Not Uploaded	Choose File No file chosen	No Answer Sheet
Soleimon	4	View	Uploaded	Processing Evaluation...

Upload Selected Files

Back to Dashboard

Fig: 9.14 Gradex Teacher Dashboard-Answer Sheet Evaluating



GradeX Hello, kumar Logout

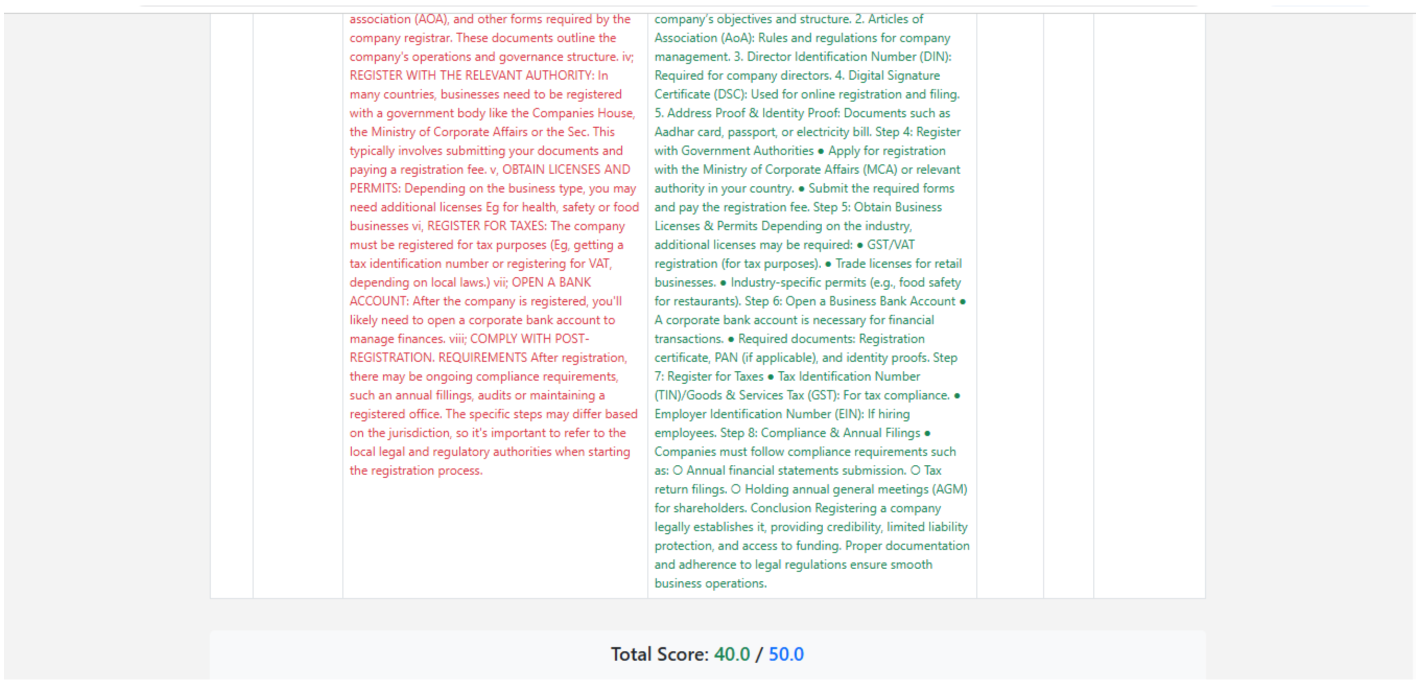
Exam Report

Exam Details

Exam Name: Python	**Student Name:** kumar
Date: 09 Mar 2025	**Roll Number:** 2
Exam Type: CAT 1	**Year:** 4

Q.No	Question	Student Answer	Correct Answer	Marks Awarded	Max Marks	Evaluation
Q1	Define Margin Market	☺ margin money. The initial deposit required by Lender or financial institution to allow the borrowing of funds for investment, typically used in stock trading.	• Answer: Margin money is a percentage of the total transaction value that a borrower is required to pay upfront when taking a loan or making an investment.	2	2	The student's answer correctly defines margin money as an initial deposit required for borrowing funds for investment.
Q2	Define equity funding	☺ Equity funding Raising Capital by chasing shares of the company to investors in exchange for ownership This can include personal savings angel investors or public stock offering	• Answer: Raising capital by selling company stock (ownership shares). Investors provide funds in exchange for equity, becoming part-owners with a claim on future profits.	2	2	The student's answer correctly defines equity funding as raising capital by selling shares for

Fig: 9.15 Gradex Teacher Dashboard-Results-1



		association (AOA), and other forms required by the company registrar. These documents outline the company's operations and governance structure. iv; REGISTER WITH THE RELEVANT AUTHORITY: In many countries, businesses need to be registered with a government body like the Companies House, the Ministry of Corporate Affairs or the Sec. This typically involves submitting your documents and paying a registration fee. v, OBTAIN LICENSES AND PERMITS: Depending on the business type, you may need additional licenses Eg for health, safety or food businesses vi, REGISTER FOR TAXES: The company must be registered for tax purposes (Eg, getting a tax identification number or registering for VAT, depending on local laws.) vii; OPEN A BANK ACCOUNT: After the company is registered, you'll likely need to open a corporate bank account to manage finances. viii; COMPLY WITH POST-REGISTRATION. REQUIREMENTS After registration, there may be ongoing compliance requirements, such an annual fillings, audits or maintaining a registered office. The specific steps may differ based on the jurisdiction, so it's important to refer to the local legal and regulatory authorities when starting the registration process.	company's objectives and structure. 2. Articles of Association (AoA): Rules and regulations for company management. 3. Director Identification Number (DIN): Required for company directors. 4. Digital Signature Certificate (DSC): Used for online registration and filing. 5. Address Proof & Identity Proof: Documents such as Aadhar card, passport, or electricity bill. Step 4: Register with Government Authorities • Apply for registration with the Ministry of Corporate Affairs (MCA) or relevant authority in your country. • Submit the required forms and pay the registration fee. Step 5: Obtain Business Licenses & Permits Depending on the industry, additional licenses may be required: • GST/VAT registration (for tax purposes). • Trade licenses for retail businesses. • Industry-specific permits (e.g., food safety for restaurants). Step 6: Open a Business Bank Account • A corporate bank account is necessary for financial transactions. • Required documents: Registration certificate, PAN (if applicable), and identity proofs. Step 7: Register for Taxes • Tax Identification Number (TIN)/Goods & Services Tax (GST): For tax compliance. • Employer Identification Number (EIN): If hiring employees. Step 8: Compliance & Annual Filings • Companies must follow compliance requirements such as: O Annual financial statements submission. O Tax return filings. O Holding annual general meetings (AGM) for shareholders. Conclusion Registering a company legally establishes it, providing credibility, limited liability protection, and access to funding. Proper documentation and adherence to legal regulations ensure smooth business operations.			

Total Score: 40.0 / 50.0

Fig: 9.16 Gradex Teacher Dashboard-Results-2

Chapter 10

Future Enhancement

While the Gradex system has successfully streamlined the process of evaluating handwritten student answer sheets using OCR and AI, the current workflow still requires manual scanning or photographing of the answer sheets before processing. A major area for improvement lies in automating this input step to make the system more seamless and scalable.

The primary future enhancement will focus on digitizing the answer sheet collection process. Instead of manually scanning or converting student-written sheets into PDFs or image formats, the system can be integrated with school digital infrastructure to automatically ingest answer sheets directly from:

- **Smart exam papers** written on digital pads or tablets with stylus input
- **Mobile app-based capture systems** where teachers simply click pictures, and the app auto-converts and uploads them to the backend
- **Scanner integration APIs** that trigger evaluation as soon as papers are scanned

This would eliminate delays, reduce human effort, and improve the overall efficiency of the system from input to evaluation.

In addition to this, several other enhancements are planned for the Gradex platform:

- **Multilingual Answer Sheet Support**
  Expanding OCR and NLP capabilities to evaluate responses written in regional languages.
- **Real-time Evaluation via Digital Input Devices**
  Supporting direct writing on tablets to allow instant feedback and auto-evaluation.
- **Learning Feedback Loop for Scoring Adjustment**
  Using machine learning models to learn from teacher corrections and adapt future scoring.
- **Advanced Student Performance Analytics**
  Generating detailed reports with topic-wise analytics, progress tracking, and feedback suggestions.

- **Plagiarism Detection**
  Adding modules to detect similar or copied content between students' answers.
- **LMS and Mobile Integration**
  Integrating with Learning Management Systems (LMS) and offering mobile apps for easy access by both students and teachers.

By focusing on automating the initial input step, Gradex will not only become more efficient but also truly scalable for large-scale educational deployments.

References

[1] Y. LeCun, Y. Bengio, and G. Hinton, "Deep learning," *Nature*, vol. 521, no. 7553, pp. 436–444, 2015.

[2] A. Graves, S. Fernández, M. Liwicki, H. Bunke, and J. Schmidhuber, "Unconstrained online handwriting recognition with recurrent neural networks," in Proc. 20th Int. Conf. Neural Inf. Process. Syst. (NIPS), 2008, pp. 577–584.

[3] S. Hochreiter and J. Schmidhuber, "Long short-term memory," Neural Computation, vol. 9, no. 8, pp. 1735–1780, 1997.

[4] M. D. Zeiler and R. Fergus, "Visualizing and understanding convolutional networks," in Proc. European Conf. Computer Vision (ECCV), 2014, pp. 818–833.

[5] R. Smith, "An overview of the Tesseract OCR engine," in Proc. Int. Conf. Document Anal. Recognit. (ICDAR), 2007, pp. 629–633.

[6] OpenAI, "GPT-4 technical report," arXiv preprint arXiv:2303.08774, 2023.

[7] R. S. Sutton and A. G. Barto, Reinforcement Learning: An Introduction, 2nd ed. Cambridge, MA, USA: MIT Press, 2018.

[8] N. Dalal and B. Triggs, "Histograms of oriented gradients for human detection," in Proc. IEEE Comput. Soc. Conf. Comput. Vis. Pattern Recognit. (CVPR), 2005, vol. 1, pp. 886–893.

[9] D. Bahdanau, K. Cho, and Y. Bengio, "Neural machine translation by jointly learning to align and translate," in Proc. Int. Conf. Learn. Represent. (ICLR), 2015.

[10] K. He, X. Zhang, S. Ren, and J. Sun, "Deep residual learning for image recognition," in Proc. IEEE Conf. Comput. Vis. Pattern Recognit. (CVPR), 2016, pp. 770–778.