# ClauseEase

**AI based Contract Language Simplifier**

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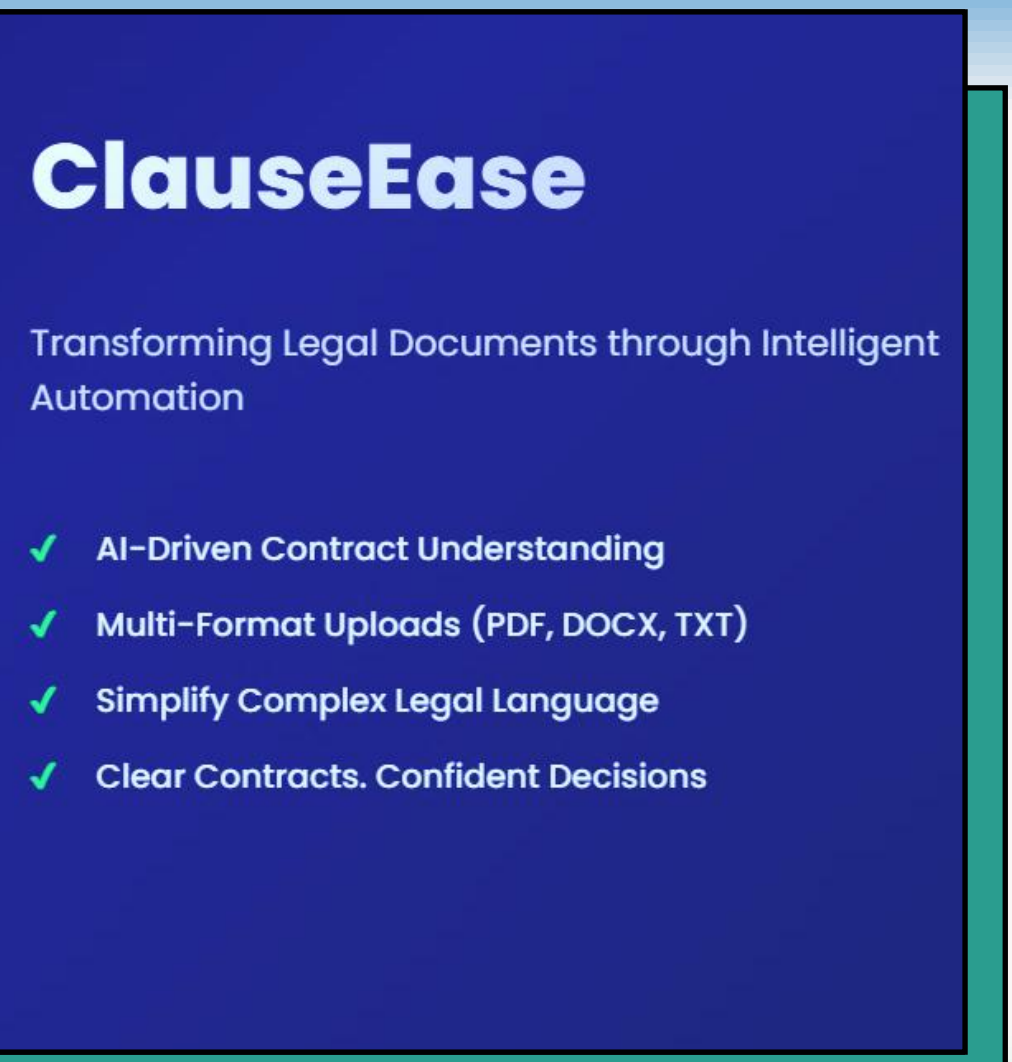


# What is ClauseEase?

## Project Statement:

Legal contracts are often written in dense, complex language that is difficult for non-lawyers to understand.

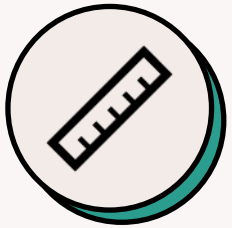
This project, **ClauseEase**, aims to build an **AI-powered system** that automatically extracts, analyses, and simplifies legal contract clauses without losing legal meaning or intent.

The goal is to make contracts more **readable, accessible, and understandable** for all users.

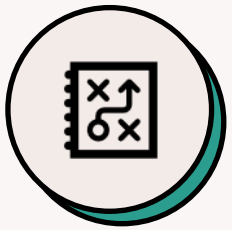
# Objectives

Automate contract text extraction and preprocessing.

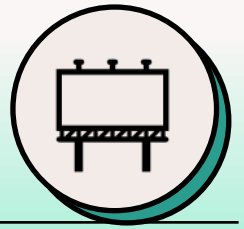
Identify and classify legal clauses using NLP and AI models.



Recognize complex legal terms and generate plain-English explanations.



Simplify contract language while preserving legal accuracy.



Provide users with an intuitive interface for contract analysis.

# ClauseEase - Modules


**Document Ingestion & Text Preprocessing**

**Legal Clause Detection**

**Legal Term Recognition**

**Language Simplification**

**Context Linking & Feedback**

# Requirement Analysis

## Hardware:

- **OS:** Compatible with Windows, macOS, or Linux.
- **RAM:** Minimum **4GB** RAM required.
- **CPU:** Processor speed of Core i5 or equivalent/higher recommended (GPU recommended for higher evaluation models)

## Basic Requirements:

- **Python 3.10** or higher
- **Web Browser:** Google Chrome / Edge / Firefox (latest version)
- **IDE / Code Editor:** VS Code / PyCharm / IntelliJ

# Software Requirement Analysis

- **Flask**
- HTML5, CSS3, JavaScript
- **Jinja2** templating (Flask integrated)
- **Docker** Desktop (for deployment)

## Integrations:

| Model Name | Purpose |
|---|---|
| `prajjwal1/bert-mini` | Legal clause classification |
| `google/flan-t5-small` | Legal text simplification / paraphrasing |
| `en_core_web_sm (spaCy)` | Entity extraction & linguistic analysis |

- **Google Firebase (Cloud Firestore)** → NoSQL database

| Py Libraries/ Dependencies | Purpose / Usage |
|---|---|
| **fitz (PyMuPDF)** | PDF text extraction |
| **python-docx** | DOCX text extraction |
| **re** | Regular expressions for cleaning text |
| **nltk** | Sentence tokenization (sent_tokenize) |
| **spacy** | Named Entity Recognition (NER) |
| **torch (PyTorch)** | Running Legal-BERT / Google t5 model |
| **transformers** | Pretrained AI models (Legal-BERT, t5-small) |
| **scikit-learn** | Basic ML utilities (label encoding, evaluation) |
| **numpy** | Numerical operations |
| **firebase-admin** | Firestore connection in Flask |
| **json / os** | File handling, data serialization |

# Data Flow Diagrams (DFDs)

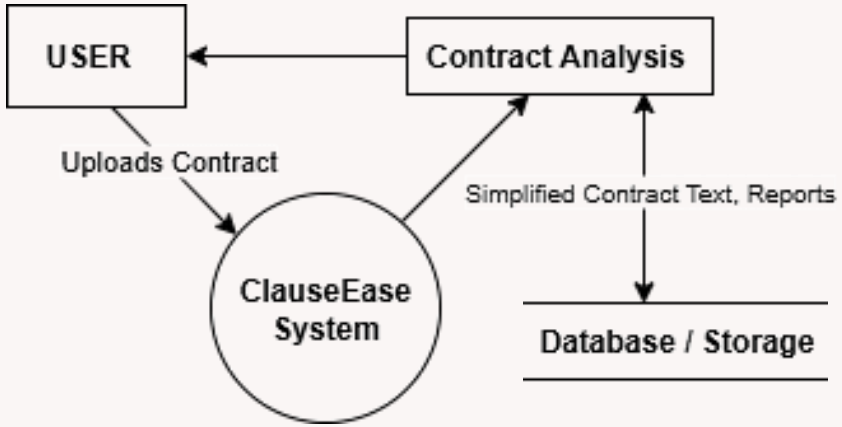



**Fig.1: 0-level DFD**

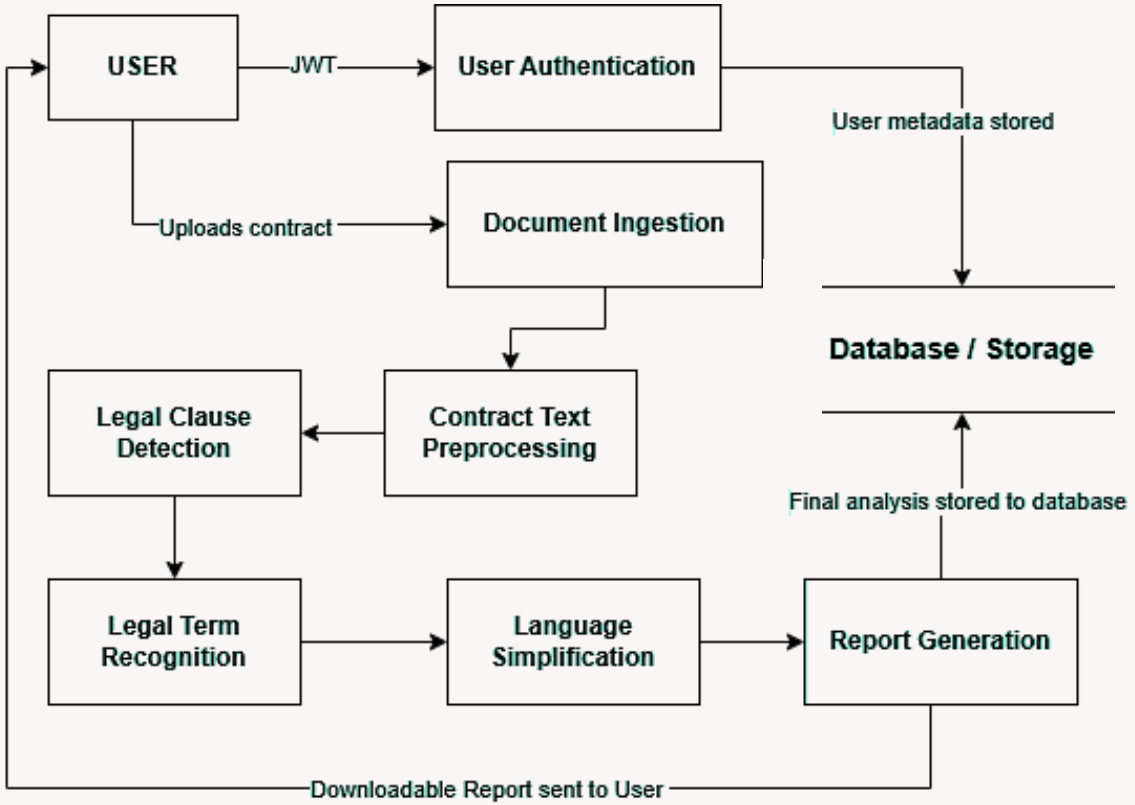
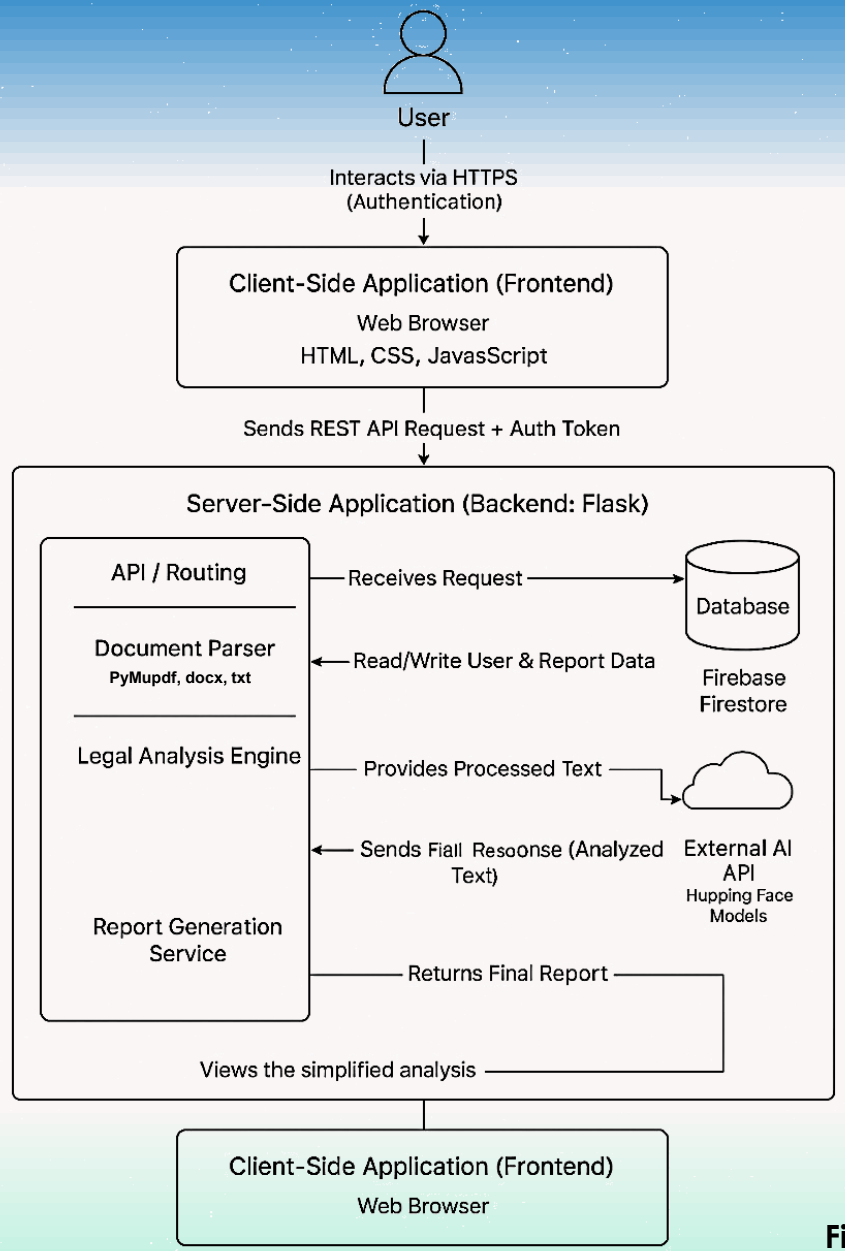



**Fig.2: Level-1 DFD**

Note:
The output can be shown into **Basic**, **Intermediate** and **Advanced** paraphrases, according to user Query

# System Architecture




- ClauseEase uses a **Flask backend** integrated with AI models for clause detection and simplification.
  - The **frontend** provides an interactive user interface, while **Firebase Firestore** securely stores user data and processed clauses.
  - Requests flow from the **Frontend → Backend → AI HuggingFace models → Results** returned and saved for real-time access.

**Fig. 3: System Architecture Diagram**

# Database Table Description

```
users (collection)
  |
  ├- user_id_1 (document)   (PK)
  |     ├──── metadata:
  |     |       ├──── name: "Arnab"
  |     |       ├──── email: "arnab@test.com"  (UK)
  |     |       ├──── password_hash: "..."
  |     |       └──── created_at: "2025-10-08"
  |     |
  |     └──── analyses (subcollection)
  |             ├──── analysis_id_1 (document)   (PK)
  |             |       ├──── uploaded_at: "2025-10-08 18:20"
  |             |       ├──── results_path: "/uploads/contract1.results.json"
  |             |       ├──── user_email: "arnab@test.com"    (FK)
  |             |       └──── details:
  |             |               ├──── file_name: "contract1.pdf"
  |             |               ├──── clause_count: 12   (PK)
  |             |               └──── simplified_text_count: 12
```

**Index:**

**PK:** Primary Key
**UK:** Unique Key
**FK:** Foreign Key

| Collection / Subcollection | Description | Key Fields / Documents |
|---|---|---|
| **users** | Main collection storing all registered user accounts and their profile metadata. | **Document ID:** unique user identifier (UID)<br>**Fields:** name, email, password_hash, created_at |
| **users → {user_id} → analyses** | Subcollection under each user storing all uploaded contract analyses. Each document corresponds to one analyzed contract. | **Document ID:** unique analysis ID<br>**Fields:** results_path (path to JSON result), uploaded_at, user_email, details (summary info like file name, clause count, etc.) |
| **analyses → file_details** | (If nested further) Holds specific details about each uploaded contract file, extracted clauses, and results metadata. | **Fields:** file_name, file_size, file_type, results_path, simplified_text_count, clause_count |
| **legal_terms** | A global collection storing predefined legal terms and definitions for recognition and glossary support. | **term**, **definition**, **category** |

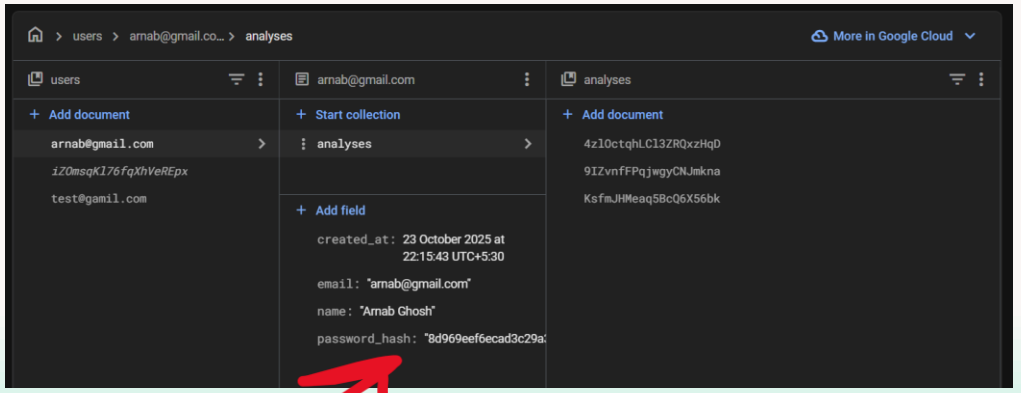
# Testing & Implementation

## Testing Techniques

- ❑ **Unit Testing:** Tested each individual module:
  - *Text Extraction*, *Clause Detection*, *Simplification*, and *Glossary Mapping* modules.
- ❑ **Integration Testing:** Verified seamless communication between:
  - Flask backend, HuggingFace models, and Firestore database.
- ❑ **API Testing (Postman):**
  - All Flask routes (e.g. `/api/analyze`) tested using **Postman** for correct request/response handling. {json output}
- ❑ **User Interface Testing:**
  - Ensured responsive layout, smooth tab switching, and accurate result rendering in HTML frontend.
- ❑ **Performance Testing:**
  - Verified handling of large contracts **(PDF/DOCX)** and AI inference time optimization.
- ❑ **Security Testing:**
  - Password hashing and authentication verified for data safety.

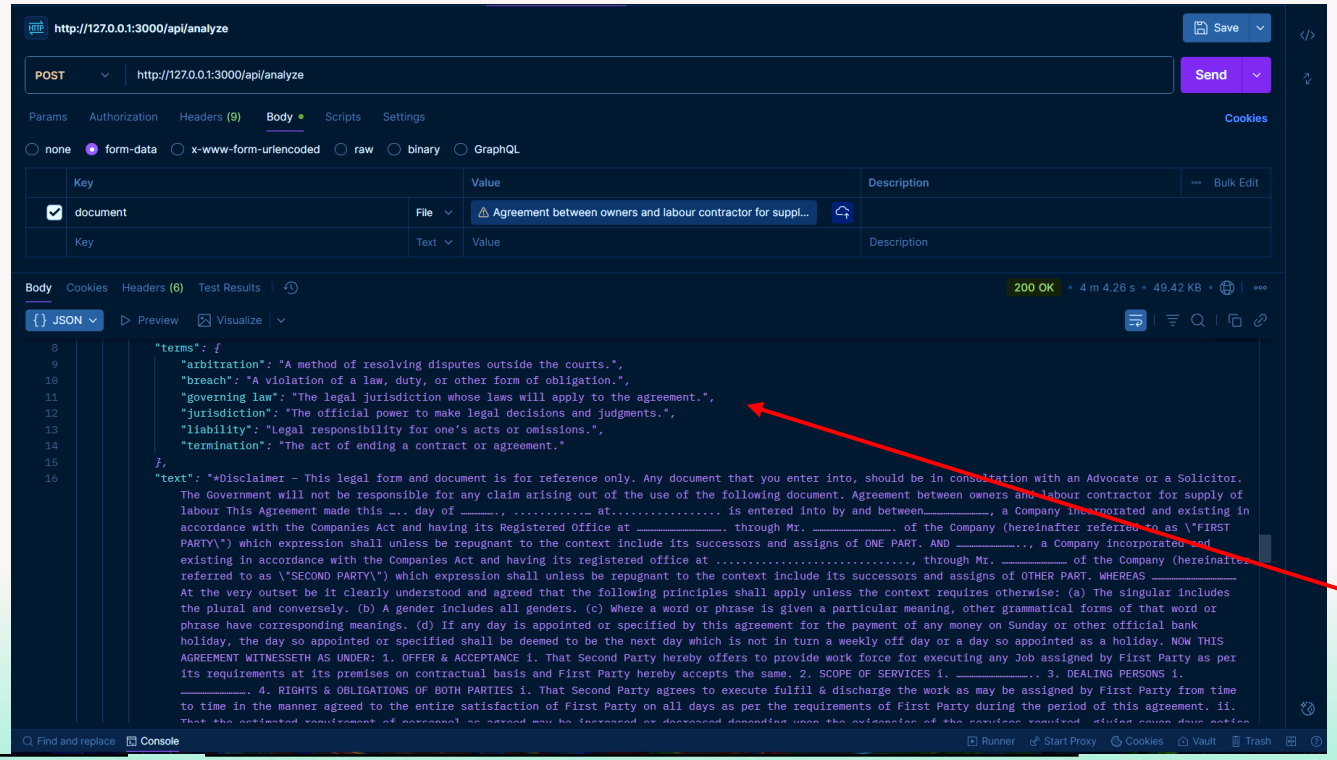
## Implementation

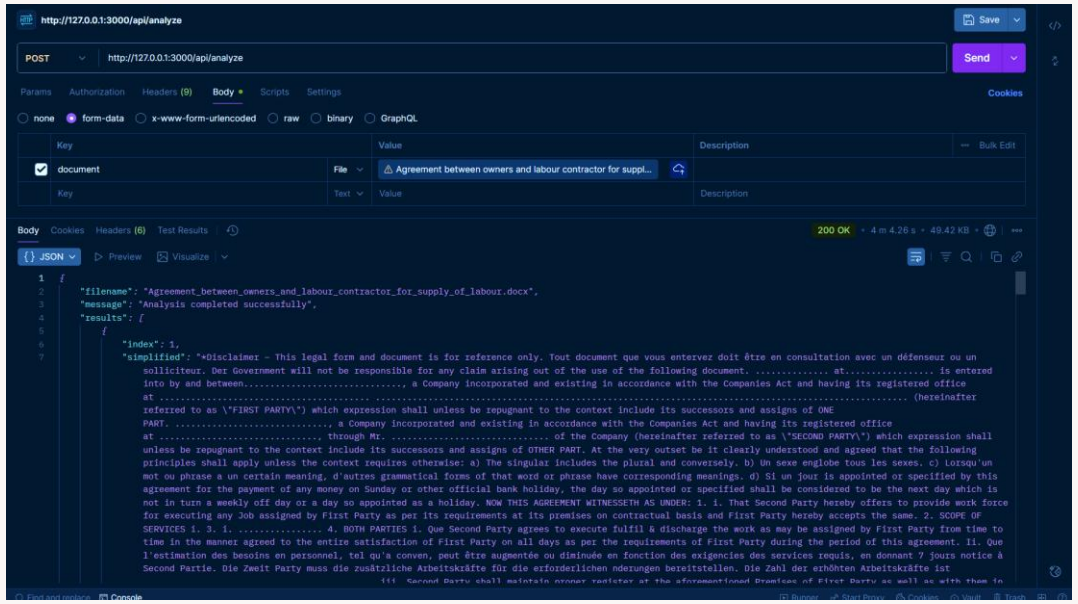
- ❑ **Frontend:** Built using HTML/CSS/JS with a clean UI following *layout.html* theme.
- ❑ **Backend:** Implemented using **Flask** for routing and model orchestration.
- ❑ **AI Processing:** BERT/NLP HF models handle clause detection and simplification logic.
- ❑ **Database:** User and analysis data securely stored in **Firestore (NoSQL)** collections.
- ❑ **Deployment:** Docker Desktop



# Application Programming Interface (API) Testing

- **Testing Tools Used:**
  - **Postman:** API validation
  - **Pytest:** Backend module testing
  - **Firebase Console:** Firestore data integrity checks

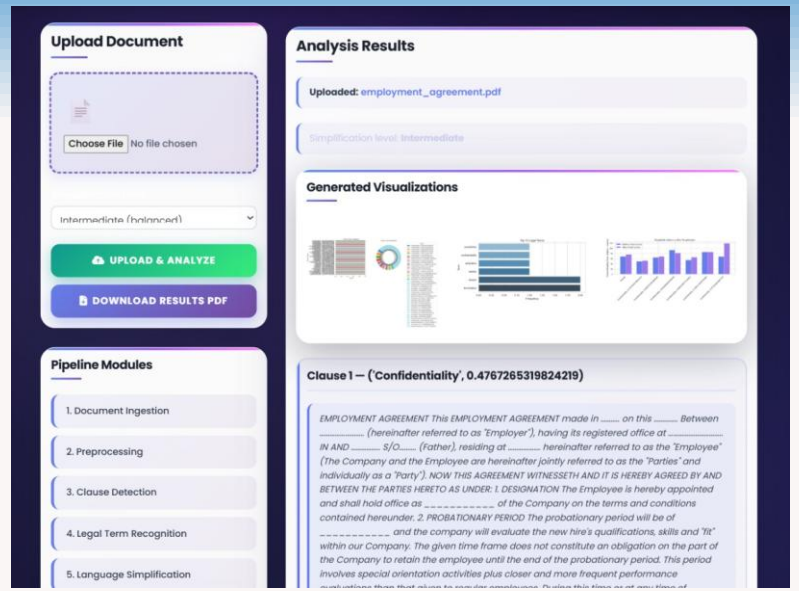


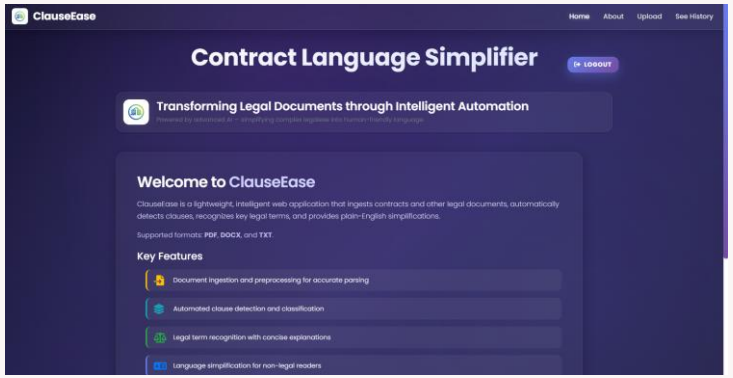

Simplified text output

Legal Terms recognized from the document

# Snapshots

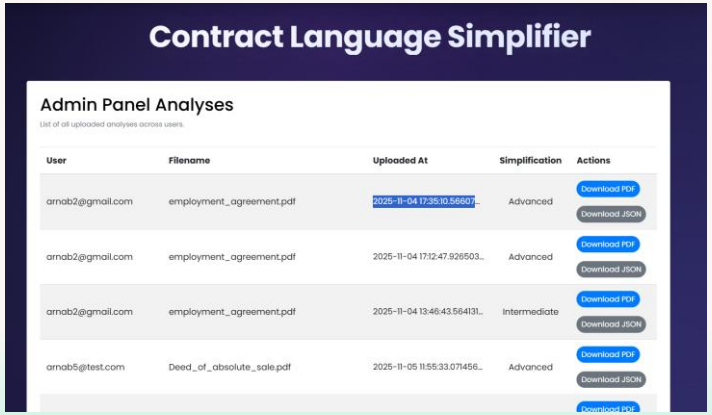



Img1: Analysis Report

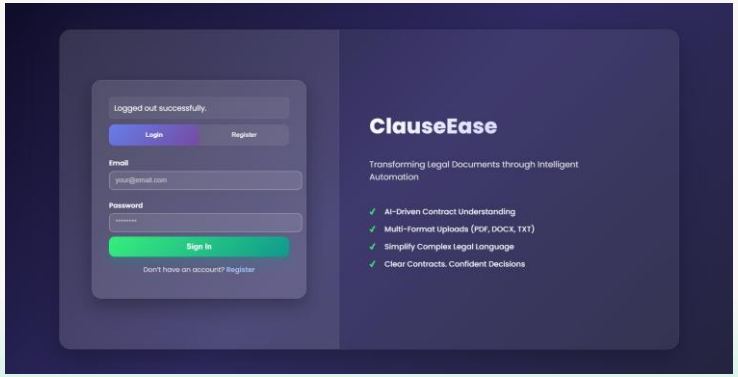



Img2: Home page


Img4: About page




Img6: Admin panel




Img3: Login/ Signup Page


Img5: See history page

# Conclusion

## Summary

ClauseEase successfully simplifies complex legal contracts using AI and NLP. It reduces the effort required to interpret legal documents and improves accessibility for users without legal expertise.

## Future Enhancements

- Integration of multilingual support for global use.
- Real-time clause comparison across multiple contracts.
- Improved summarization using advanced LLMs.
- Legal chatbot assistant for query-based explanations.
- Integration with document management systems for enterprise use.

# References


- Hugging Face Transformers Library.
- NLTK & SpaCy documentation.
- Legal Text Simplification Research Papers.
- Flask & Bootstrap Official Documentation.
- Infosys Springboard Learning Resources.

# Thank you

**Project: ClauseEase** | Contract Language Simplifier

**Infosys SpringBoard Virtual Internship 6.0**