BR18 Document Automation

AI-Powered Fire Safety Documentation for Danish Building Projects

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Problem Statement

- Manual BR18 document creation is:
  - Time-consuming and error-prone
  - Requires expert knowledge of building regulations
  - Inconsistent across different consultants
  - Difficult to keep updated with regulation changes

Solution: AI-Powered Document Automation

- Automated BR18 documentation using:
  - 🤖 Google Gemini 2.5 Flash AI Model
    - For PDF extraction and document generation
  - 🧠 RAG (Retrieval-Augmented Generation)
    - Learn from approved examples and BR18 regulations
  - 📊 Vector Database (ChromaDB)
    - Intelligent knowledge retrieval and storage

System Architecture

- Three-Layer Architecture:
  - **1. Input Processing Layer**
    - PDF extraction • Project parsing • Data validation
  - **2. Knowledge Layer (RAG)**
    - Vector database • Example documents • BR18 regulations • Municipal responses
  - **3. Generation Layer**
    - Context retrieval • AI generation • BR18 § citations • Quality validation

Del 1: Automatic Project Input Processing

- Automated extraction from project PDFs:
  - ✓ Parse project specification PDFs
    - Gemini Vision extracts structured data
  - ✓ Extract building parameters
    - Fire class, area, floors, occupancy
  - ✓ Determine required documents
    - Automatic based on BK1/BK2/BK3/BK4
  - ✓ Intelligent form filling
    - Pre-populate with extracted data

Del 2: Knowledge Base & Learning System

- RAG System Components:
  - 📚 **Example Document Processing**
    - Upload approved START/DBK/ITT documents
  - 📚 **BR18 Regulation Embedding**
    - ~80 chunks with § paragraph preservation
  - 📚 **Municipal Response Parsing**
    - Extract patterns from approvals/rejections
  - 📚 **Confidence Scoring**
    - Rank knowledge by quality and approval status

How RAG Improves Document Quality

- **WITHOUT Knowledge (Baseline):**
  - User Input → Gemini → Generic Document
    - ❌ Missing BR18 § citations
    - ❌ Inconsistent structure

- **WITH Knowledge (RAG):**
  - User Input → Vector DB → [3 Examples + 3 BR18 §] → Gemini → Enhanced Document
    - ✓ Accurate BR18 §508, §93 citations
    - ✓ Professional structure from examples

BR18 Regulation Integration

- ## Solves Del 1, 2, and 3 requirements:
  - – ✓ Intelligent § paragraph references
    - • BR18.pdf embedded → retrieve relevant paragraphs during generation
  - – ✓ BR18 update handling
    - • Re-upload BR18.pdf → deletes old chunks → adds new version
  - – ✓ Validation against current BR18
    - • Citations verified during generation (not needed post-hoc)

User Interface - 4 Tabs

- ①**Parse Project (Del 1)**
    - Upload PDF → Extract building data automatically
- ②**Knowledge Base (Del 2)**
    - Upload examples + BR18 → Build RAG database
- ③**Generate Documents**
    - Create START/DBK/ITT with/without knowledge
- ④**View Knowledge**
    - Browse database, search, view statistics

Key Innovation: Comparison Mode

- Demonstrate RAG effectiveness:
  - Generate WITHOUT knowledge
    - Saved to: data/generated_docs/without_knowledge/
    - Baseline quality, missing BR18 specifics

  - Generate WITH knowledge
    - Saved to: data/generated_docs/with_knowledge/
    - Enhanced quality, accurate BR18 § citations

Technologies Used

- **Google Gemini 2.5 Flash**
  - AI model for extraction & generation
- **Gemini Vision**
  - PDF content extraction
- **ChromaDB**
  - Vector database for embeddings
- **Gemini Embedding 001**
  - 768-dimensional text embeddings
- **CustomTkinter**
  - Modern dark theme GUI
- **Python 3.10**
  - Core implementation

Performance & Cost

- ## Operation Performance:
  - Parse project PDF: 10-30 seconds • $0.02
  - Extract example document: 30-60 seconds • $0.10
  - Upload BR18 regulation: 1-2 minutes • $0.15 (one-time)
  - Generate document (no knowledge): 15-30 seconds • $0.03
  - Generate document (with knowledge): 20-40 seconds • $0.05

- **Total Setup: ~$0.50-1.00 (one-time)**
- **Per Document: ~$0.03-0.05**

Results & Benefits

- ⚡ **Speed**
  - Generate documents in 20-40 seconds vs hours manually
- 🎯 **Accuracy**
  - Automatic BR18 § citations verified against regulations
- 📚 **Consistency**
  - Learn from approved examples, consistent quality
- 🔄 **Adaptability**
  - Easy BR18 updates, no manual citation changes
- 💰 **Cost-Effective**
  - $0.03-0.05 per document, minimal ongoing costs
- 🧠 **Continuous Learning**
  - Improves from municipal feedback over time

Demonstration Flow

- 1. Parse project PDF → Automatic extraction
- 2. Upload example documents → Build knowledge base
- 3. Upload BR18.pdf → Enable § citations
- 4. Generate WITHOUT knowledge → Baseline document
- 5. Generate WITH knowledge → Enhanced document
- 6. Compare results → Demonstrate improvement
- 7. View knowledge base → Browse statistics

Conclusion

- Successfully implemented:
  - ✓ All Del 1, 2, 3 requirements fulfilled
  - ✓ RAG system with BR18 integration
  - ✓ Automatic document generation
  - ✓ Comparison mode demonstrates value

Thank You

Questions?

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