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ZADANIE TÍMOVÉHO PROJEKTU

Vedúci tímového projektu: Ing. Stanislav Marochok

Názov práce: **Collaborative Platform for Digitisation, Annotation, and Decryption of Historical Ciphers**

Jazyk, v ktorom sa práca vypracuje: slovenský jazyk

Špecifikácia zadania:

The aim of this project is to design and implement a full-stack web application for the processing of historical handwritten and printed encrypted texts together with handwritten cipher key documents. These sources include cipher keys, fully encrypted texts, semi-encrypted texts, and mixed pages where both keys and texts appear together. The application should provide researchers and students with modern tools for digital preservation, pre-processing, annotation, recognition, reconstruction, symbol mapping, and decryption, all within a single collaborative platform.

The system is expected to cover the entire workflow from uploading digitized images to creating machine-readable editions that can be directly applied to decipher encrypted texts. It should allow multi-level annotation of regions, entries, and symbols, enabling users to highlight areas of interest, classify symbols, reconstruct substitution tables, and link plaintext with ciphertext. To support this functionality, the processing pipeline will combine pre-processing methods such as normalization, binarization, deskewing, segmentation, and noise reduction with both AI-based and heuristic approaches. The AI modules should include handwriting recognition, symbol detection, and table reconstruction, while the non-AI modules should rely on contour analysis, morphological operations, and rule-based reconstruction. A unified symbol mapping system will normalize all detected objects into a shared database of codes, ensuring that digitalized cipher keys can be applied seamlessly to digitalized encrypted texts.

Beyond the technical pipeline, the platform will also include user management with different roles, shared workspaces for projects, and document sharing features. A credit and attribution system will ensure that contributions such as annotations, reconstructions, and decryptions are transparently recorded. Users will also interact with a system of virtual points that they earn by contributing work on the platform and can later spend on advanced actions such as launching automatic symbol detection or AI-based table reconstruction. The decryption module will connect the different parts of the system by allowing reconstructed cipher keys to be applied directly to encrypted passages with support for frequency analysis, automatic suggestions, and manual corrections.

The final outcome of the project will be a cloud-deployed, production-ready application that integrates pre-processing, annotation, recognition, reconstruction, decryption, and collaborative features, including user management, document sharing, credits, and virtual points. It will also include both AI and non-AI methods, a demonstrator dataset of annotated pages, and comprehensive documentation.

1. Study the domain – research encrypted texts, cipher keys, AI and non-AI methods, and preprocessing techniques.

2. Design the system – define requirements, architecture, user management, sharing, credits, and virtual points.

3. Plan the project – prepare timeline, milestones, assign roles, set up tools.

4. Model the system – create UML diagrams and database schemas.

5. Implement the application – build backend, frontend, preprocessing, AI and non-AI modules, reconstruction, user management, sharing, credits, and virtual points.

6. Test the system – perform unit, integration, and system tests; compare AI and non-AI methods; evaluate reconstruction and decryption on synthetic and historical data.

7. Write documentation – prepare user guides, technical documentation, and the final report.