**Test plan for a flask-app**

**Application Overview**

The Flask API backend serves as a robust automation platform for video generation, designed to streamline and enhance the process through a suite of RESTful endpoints. The application's key functionalities include comprehensive CRUD operations for managing entities such as users, projects, scripts, audio files, images, and renders.

* **Script Generation:** Utilizes ChatGPT for generating scripts based on predefined themes or project requirements.
* **Image Generation:** Employs DallE for creating images that complement the generated scripts and project themes.
* **Rendering Capabilities:** Offers functionalities for generating slideshows, incorporating voiceovers generated via OpenAI's text-to-speech (TTS) service, and adding subtitles using the ZapCap API.

The backend architecture is structured into distinct layers:

* **API Layer:** Implements RESTful endpoints using Flask, facilitating intuitive interaction with the application's functionalities.
* **Service Layer:** Houses the business logic responsible for orchestrating AI-based content generation and integrating external APIs for additional functionalities.
* **Repository Layer:** Manages database operations, ensuring efficient storage and retrieval of project-related data.

**Scope of Testing**

**Modules to be Tested:**

1. **API Layer:**
   * Flask endpoints responsible for CRUD operations (users, projects, scripts, audio, images, renders).
   * Integration with AI services (ChatGPT for script generation, DallE for image generation, OpenAI TTS for voiceovers).
   * Integration with third-party APIs (ZapCap for subtitles).
2. **Service Layer:**
   * Business logic for orchestrating AI-based functionalities.
   * Script generation based on themes or project requirements.
   * Image generation to complement generated scripts and project themes
   * Rendering capabilities of in-house movie editor service.
3. **Repository Layer:**
   * Database operations for storing and retrieving data related to users, projects, scripts, etc.

**Modules Not to be Directly Tested:**

* External AI services (ChatGPT, DallE, OpenAI TTS, ZapCap): These services are assumed to be tested and functioning correctly by their respective providers. Our testing will focus on integration points and handling of responses.

**Testing Approaches and Methodology**

**Approach:** Our testing approach integrates both traditional and modern methodologies to ensure comprehensive coverage and reliability of the Flask API backend. We emphasize:

* **Agile Testing:** Iterative testing throughout development cycles to catch issues early.
* **TDD:** In case of post-MVP (Minimum Viable Product) feature development the testing practice should follow steps defined by TDD.
* **Continuous Integration/Continuous Deployment (CI/CD):** Automated testing integrated into CI/CD pipelines for rapid feedback and deployment assurance. Including static code analysis, quality gates should be well defined.

**Methodology:**

* **Risk-based Testing:** Prioritizing tests based on potential impact and likelihood of failure.
* **Exploratory Testing:** Manual testing to uncover unforeseen issues and ensure usability.
* **Test Automation:** Using frameworks like pytest for automated testing to improve efficiency and consistency.

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#### **Types of Testing**

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| Functional Testing | Objective | Criteria |
| **Unit Testing** | Validate individual components (functions, methods, classes). | High code coverage (80%+) for critical paths. Mock external dependencies (AI services, third-party APIs) to maintain test independence. |
| **Integration Testing** | Validate interactions between components (API, services, repository). | Test data flow and transformations across layers. Verify error handling and edge case scenarios. |
| **Contract Testing** | Validate responses from third party APIs. | Define data transfer objects and test API response structure. |
| **End-to-End Testing** | Validate complete user workflows from API request to final output (rendered video). Ex. pytest-bdd | Test user scenarios including script generation, image rendering, and final render creation. |

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| Non-Functional Testing | Objective | Criteria |
| **Performance Testing** | Identify performance bottlenecks and optimize system performance.  Ex. locust | Define performance metrics (e.g., response time < 500ms). |
| **Security Testing** | Identify and mitigate security vulnerabilities.  Ex. pip-audit | Scan dependencies and third party libraries for security issues. |
| **Penetration Testing** | Assure the robustness and security of our API.  Ex. ZAP | Test for security breaches through API’s endpoints. |

**Test Schedule and Timeline**

A static code analysis tool should get included into the project’s git flow as a github action, to ensure that the codebase is compliant with modern python coding standards.

Functional testing should be done first, focusing from most critical to least critical parts of the codebase. After identifying such a critical code part, unit tests should pass, following that we can integrate the unit tested parts and test cross-module work flows. During integration with a third party library contract tests should be defined and maintained as border tests, to alert any changes of external APIs. Following these steps complete user workflows should get tested in a BDD manner. Gherkin is offered by pytest-bdd to define expected behaviors.

Once functional testing ensures our minimum viable product to meet defined criterias, security and penetration testing should get included into our pipelines.

Before the release of a beta version performance testing should validate our response times.

**Testing convention**

During functional testing, the implementation in pytest should follow integration conventions described in the original documentation: https://docs.pytest.org/en/7.1.x/explanation/goodpractices.html

**Identified Risks**

**Resource Constraints:** Limited availability of testing resources (e.g., time, personnel) may delay testing activities.

**Integration Complexity:** Complex integrations between API endpoints, AI services, and third-party APIs may result in integration failures.

**ZapCap development:** The third party API used for subtitle generation is in alpha version, meaning it is still under development and can be subject to drastic changes. The development process and detailed explanations are available on their Discord server, it is advised to monitor them.

#### **Mitigation Strategies**

* + Establish regular checkpoints to monitor test progress and identify potential bottlenecks early.
  + Develop contingency plans for identified risks to minimize impact on testing timelines.
  + Maintain flexibility in testing schedules to accommodate unexpected delays or issues.
  + Ensure testing team members are adequately trained in testing methodologies and tools.