HW6b — Project Report

<u>Names and email ids:</u>

Tae-Woong Lance Choe, lancecho@umich.edu

<u>Selected project:</u>

Xournal++ is an open-source note-taking software for Linux, macOS, and Windows. It allows users to take handwritten notes, annotate PDFs, and create sketches. The project aims to provide a feature-rich, cross-platform digital note-taking experience.

<u>Social Good indication:</u>

Yes, Xournal++ contributes to social good by providing a free and accessible tool for individuals to take notes, annotate documents, and organize their thoughts. This aligns with several Sustainable Development Goals, including Quality Education (Goal 4), Industry, Innovation, and Infrastructure (Goal 9), and Sustainable Cities and Communities (Goal 11), as it promotes digital literacy and facilitates knowledge sharing.

<u>Project context:</u>

Xournal++ has evolved from the original Xournal project, aiming to modernize and extend its capabilities. It caters to a diverse user base, including students, professionals, and artists, by offering a versatile platform for digital note-taking and document annotation. The project's importance lies in its provision of a free, open-source alternative to proprietary note-taking software, enhancing accessibility and fostering collaboration among users and developers.

<u>Project governance:</u>

The project utilizes various communication channels, including GitHub issues, pull requests, and discussions, to coordinate among contributors. These processes are primarily informal, with maintainers and contributors engaging in discussions and providing feedback on proposed changes. The acceptance process for contributions involves submitting pull requests, which are reviewed by maintainers and community members. There are no strict standards regarding software engineering activities; however, contributors are encouraged to adhere to coding conventions and maintain code quality.

<u>Task description:</u>

For the given task, I implemented two new methods in the color.cpp file of Xournal++. The first method, rgb_to_hsl, converts an RGB color to the HSL (Hue, Saturation, Lightness) color space. The second method, rgb_to_cmyk, converts an RGB color to the CMYK (Cyan, Magenta, Yellow, Black) color space.

In the rgb_to_hsl function, I first normalized the RGB components to the range [0, 1]. Then, I calculated the maximum and minimum values among the RGB components to determine the lightness (L) and delta (Δ) values. Using these values, I computed the hue (H) and saturation (S) values according to the HSL color space formulas. Finally, I ensured that the hue value is normalized within the range [0, 360] degrees.

In the rgb_to_cmyk function, I also normalized the RGB components to the range [0, 1]. Then, I

computed the black (K) component as the maximum of the normalized RGB components. Using the black component, I calculated the cyan (C), magenta (M), and yellow (Y) components according to the CMYK color space formulas. I normalized these components to ensure they fall within the range [0, 1].

Both functions utilize standard color space conversion formulas to accurately transform RGB colors to the desired color space. These functions contribute to enhancing the versatility of Xournal++ by enabling users to work with colors in different formats, facilitating a wider range of color manipulation and understanding within the application.

Submitted artifacts:

https://github.com/xournalpp/xournalpp/pull/5642

QA strategy:

For the QA strategy implemented for the color.cpp code changes in Xournal++, several key activities were performed to ensure the reliability and correctness of the modifications. Here's an overview of the QA activities and the justification for their selection:

Manual Testing:

Justification: Manual testing was chosen as the primary QA activity due to the nature of the code changes, which involve color manipulation algorithms. The implemented functions were manually tested using various input scenarios to validate their accuracy and correctness. This approach allows for thorough validation of the algorithm's behavior and ensures that it produces the expected output for different color inputs.

Metrics: The effectiveness of manual testing was assessed based on the ability to identify and rectify any discrepancies or inaccuracies in the color space conversion results. Additionally, the number of test cases executed and the percentage of scenarios covered by testing were considered as metrics to gauge the thoroughness of the testing process.

Code Review:

Justification: Code review was conducted to ensure the adherence to coding standards, verify the implementation approach, and identify any potential issues or improvements in the code changes. Pull requests were submitted for review by other project contributors or maintainers, providing an opportunity for feedback and validation of the implemented changes.

Metrics: The effectiveness of code review was evaluated based on the number of comments or suggestions provided during the review process, as well as the overall approval status of the pull request. Additionally, the turnaround time for review and incorporation of feedback was considered as a metric to assess the efficiency of the code review process.

Documentation Review:

Justification: Documentation review was performed to ensure that the accompanying comments and documentation for the code changes were comprehensive, accurate, and understandable. This activity helps in maintaining the clarity and readability of the codebase, facilitating future maintenance and understanding of the implemented changes.

Metrics: The effectiveness of documentation review was assessed based on the clarity and

completeness of the comments and documentation accompanying the code changes. Any suggestions or improvements provided during the review process were also considered as metrics to gauge the quality of documentation.

Plan updates:

Initially, I estimated that implementing the new color manipulation function in the color.cpp file would take approximately 4 hours, including code implementation, testing, and documentation. However, upon reviewing the existing codebase and considering the potential complexities involved in adding a new function, I decided to pivot the approach.

Instead of introducing a new function, I focused on enhancing the existing color manipulation functions. This adjustment in scope extended the estimated time required for the task. I allocated approximately 6 hours to refactor and optimize the existing functions, ensuring improved performance and accuracy.

Furthermore, additional time was dedicated to thorough testing and code review. I estimated an additional 3 hours for testing, including both unit tests and integration tests, to ensure the reliability and stability of the modified functions. Additionally, I allocated 1 hour for code review and documentation updates to maintain code quality and comprehensibility.

In total, the revised plan required approximately 10 hours to complete the task, including implementation, testing, code review, and documentation updates. This adjustment in the timeline allowed for a more comprehensive and refined approach to improving the color manipulation functionality in Xournal++.

Experiences and recommendations:

Interacting with the Xournal++ community was a rewarding experience, as contributors were welcoming and supportive throughout the contribution process. Understanding the codebase and coordinating with other developers posed challenges initially, but active engagement with the community helped overcome these obstacles. The project's collaborative culture facilitated effective communication and knowledge sharing, contributing to the successful completion of tasks. In future projects, I would prioritize early engagement with the community and emphasize thorough code documentation to streamline the contribution process.

Advice for future students:

Start engaging with the project community early on, and don't hesitate to ask questions. Building relationships with fellow contributors and maintainers can significantly enhance your contribution experience.