Software Requirements Specification

for

Xournal++

Requirements for Version 1.2.2

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1. Introduction

1.1 Purpose

This document includes software requirements for Xournal++, release number 1.2.2. Xournal++ is an Open Source Software distributed under the terms of the GNU General Public License Version 2 or later. Its primary purpose is to provide an interface for annotating PDF documents or creating new documents for note-taking. The system is cross-platform and provides several functionalities on existing or new documents which can be exported as PDF or other format files.

This document follows "Software Requirements Specification" template for software requirements specification documents, by Karl E. Wiegers, with a few deviations.

1.2 Document Conventions

- When writing this document it was assumed that all requirements have the same priority.
- Firstly, an overall view of Xournal++ is provided, followed by a detailed presentation of all its features and functions.

1.3 Intended Audience and Reading Suggestions

This document is aimed at developers, software engineers or any member of the Xournal++ community, as well as users and testers.

The rest of the document is divided into the following chapters:

- In chapter 2 an overall description of Xournal++ is provided. Firstly, product perspective is presented with a brief description of product features and main functions, followed by user classes and characteristics, operating environments that Xournal++ supports as well as design and implementation constraints. In the end of the chapter the reader is referred to the user documentation for further information, and also some assumptions and dependencies are mentioned.
- In chapter 3 user, hardware, software and communication interfaces are noted.
- In chapter 4 all features and functions are presented in detail. Almost every feature is described in the following subsections:
    - "Description and Priority", where general and noteworthy information is presented,
    - "Stimulus/Response Sequences", describing the series of actions to be performed by the user in order to use the feature and
    - "Functional Requirements" where one or two requirements in order for the feature to work are stated.
- In chapter 5 requirements about safety and performance are presented.

1.4 Product Scope

Xournal++ is a note-taking software for either annotating an existing PDF document or creating new notes in a handwritten manner similar to physical notes taken in a book or notebook/journal, while also benefitting from the advantages of digital tools to ameliorate the quality of these notes. Thus, it offers the user numerous possibilities such as freehand drawing, typing text or adding shapes, highlighting, inserting images, setting the background to a specific type of notebook page layout, and many more. Xournal++ is also designed for tablet PCs and other similar devices, providing features such as a stylus or touch input. As a digital note-taking solution, it can be used for adding one's signature to an administrative document, making elaborate comments, annotating one's studying material or presentation, solving or correcting exercises, or even for online courses.

Initially Xournal++ started as a rewrite of Xournal in C++, hence the name. Nonetheless, it has since grown beyond Xournal into a feature-rich software that stays under active development, while its much more limited predecessor is now considered deprecated.

1.5 References

Information about Xournal++ can be found in Xournal++'s official website and GitHub page:
https://xournalpp.github.io/
https://github.com/xournalpp/xournalpp/

2. Overall Description

2.1 Product Perspective

Xournal++ was created for handwritten note-taking and sketching, as a rewrite of Xournal, another open source tool for annotating PDFs, using the Poppler library to render them. Xournal++ is written entirely in C++, still using the Poppler library. The still active development of its numerous features has outdated Xournal. Xournal++ uses the .xopp file extension, but it also provides the possibility to export documents in PDF and other formats. It is a cross-platform software that does not require any other installations to operate. Xournal++ is developed under GNU General Public License version 2 or later and can be distributed under those terms. It is available for download on SourceForge, Flathub, Snapcraft and the project's official website.

2.2 Product Functions

Xournal++ is a note-taking and sketching software aiming to provide a cross-platform graphical interface for many utilities. These utilities offer a variety of functions that are briefly presented in the following list:

- PDF annotation – Setting a PDF file as a background, navigating through the file, searching for text in the file, selecting text on the file to highlight, underline, strikethrough, copy to clipboard, exporting as PDF.

- Editing – Selecting objects, copying to and pasting from clipboard, searching, deleting objects, snapping.
- Layers – Creating multiple layers, navigating through layers.
- Journal management – Inserting and deleting pages, navigating through (annotated) pages, managing paper format, background and layout.
- Tools – pen for freehand drawing, eraser, highlighter, shape drawing, text typing, selecting, arranging space, using geometry tools (setsquare, compass).
- TeX – using TeX typesetting system to add scientific text.
- Audio Recording – Taking audio notes.

2.3 User Classes and Characteristics

Xournal++ is not directed at any particular group; instead it is a software for anyone who might need to use digital notes and documents for administrative, educational or other purposes. Hence, there is no specialized knowledge or technical expertise required other than basic computer skills. Xournal++'s environment is very user-friendly, providing a GUI with a quick access toolbar for its most frequently used functions.

2.4 Operating Environment

Xournal++ is a 64-bit application written with GTK3, compatible with Windows, Linux and macOS. It is designed to be a lightweight application and should work on a wide range of devices, since it is not particularly resource-intensive.

2.5 Design and Implementation Constraints

Xounral++ aims to be cross-platform and relies on external libraries, namely GTK3 and Poppler, so its development might induce constraints related to these requirements, as well as other constraints related to user interface guidelines on different platforms. Xournal++ is an Open Source Software licensed under the GPL2, so it must comply with all related principles and terms.

2.6 User Documentation

A detailed user documentation is available on the project's website, including installation instructions and a user's guide to all of the available features. Other useful manuals can be found in the project's wiki on GitHub.

2.7 Assumptions and Dependencies

Xournal++ main runtime dependencies include the Poppler library and GTK's Glib 2.0 libraries, bundled with the program's installation. Also, in order for the `Add/Edit TeX` tool to be enabled, Xournal++ also requires a working LaTeX installation. Finally, to enable the functionality of certain Lua plugins in Xournal++, a compatible version of Lua must be installed on the system.

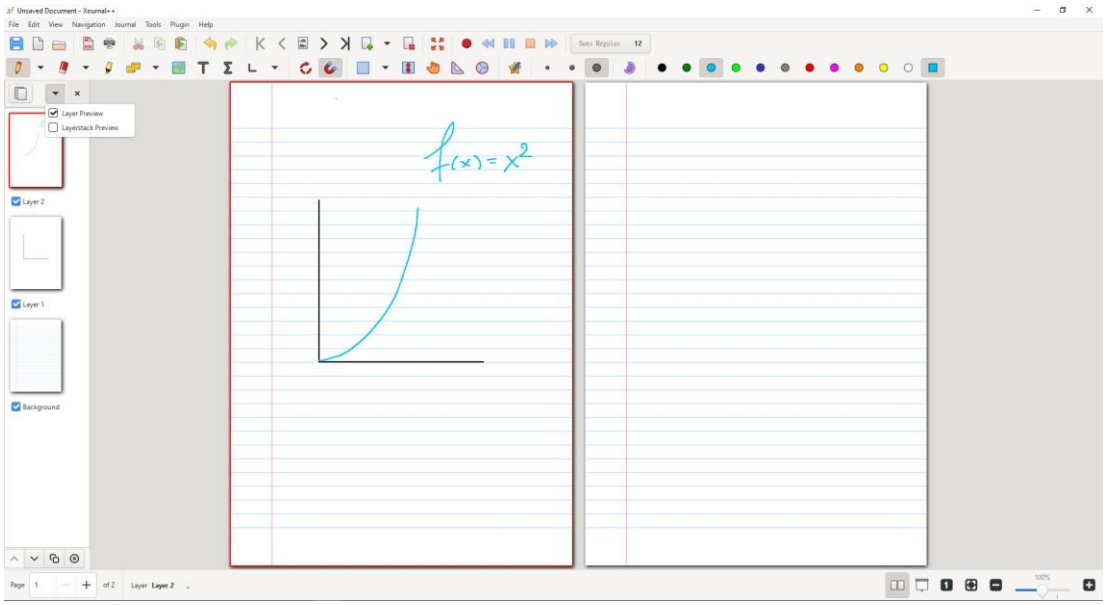
3. External Interface Requirements

3.1 User Interfaces

User interface includes various forms and windows. The main window consists of the main menubar with File, Edit, View, Navigation, Journal, Tools, Plugin and Help. Under main menu there is a toolbar with shortcuts to most used functions of Xournal++. Those appear in the form of buttons and are separated in the following categories:

- File management toolbar: Save, New Xournal, Open, Export as PDF, Print
- Edit toolbar: Cut, Copy, Paste, Undo, Redo
- Navigation & Journal toolbar: Annotated page navigation, Insert page (with page layout options scrollbar), Delete current page
- View toolbar: Toggle fullscreen
- Audio toolbar: Record Audio/Stop Recording, Back, Pause/Play, Stop, Forward
- Font toolbar: Select Font
- Tools toolbar: Pen (with style options scrollbar), Eraser (with mode options scrollbar), Highlighter, Select PDF text, Image, Text, Add/Edit TeX, Draw Shape (with shape options scrollbar)
- Edit toolbar: Rotation Snapping, Grid Snapping
- Tools toolbar: Select (with mode options scrollbar), Vertical Region, Hand, Setsquare, Compass, Default Tool
- Options Toolbar: Fine, Medium, Thick, Fill, Colors, Custom Color

On the left side, there is a Page/Layer/Layerstack Preview which gives the possibility not only to view and navigate pages and layers, but also to insert, delete, duplicate pages or layers. The center of the layout is naturally dedicated to the journal. Finally, the bottom toolbar provides a page numbering facilitating navigation, view options for layers as well as view options of the whole document, i.e., Paired page,



Presentation mode, Zoom to 100%, Zoom fit to screen, Zoom out, Zoom slider and Zoom in.
Other windows include New, Open, Annotate PDF, Save, Save as, Export as… and Export as PDF window, which is a standard file system browse, Preferences window with a side menu for various customization options, Configure new page template window, Add/Edit TeX window for writing TeX formulas, and Plugin windows.
Xournal++ utilizes basic keyboard shortcuts (`Ctrl+N` for New File, `Ctrl+F` for Find etc.), all mentioned to the right of their corresponding function in the interface menu.

3.2 Hardware Interfaces

Xournal++ interacts with an audio interface whenever using the `Record Audio` tool.

3.3 Software Interfaces

Xournal++ interacts with the aforementioned software (see 2.7), as well as with the graphical and file system interfaces. In addition to its core functionality, Xournal++ features a Plugin API, specifically designed for Lua scripting.

3.4 Communications Interfaces

Internet connection and a browser are required in order to access online help, including documentation, guides and general information.

4. System Features

In this chapter, all functions of Xournal++ are explained in detail. System features are presented in their order of appearance in the program's interface. Some common-logic features are grouped together.

4.1 New

This feature provides the ability to create a new journal.

4.1.1 Description and Priority

It creates a new, empty journal. It is one of the first actions a user must do to begin a new document.

4.1.2 Stimulus/Response Sequences

The program's startup state is by default a new journal, so this feature is useful when one has already created or opened an existing document and wants to start a new one. If not already saved in memory, Xournal++ asks the user whether to save the previous document.

4.1.3 Functional Requirements

There are no requirements for `New`.

4.2 Open

This feature opens a file browser window.

4.2.1 Description and Priority

This feature opens a file browser window at the last used location. The only files available for selection are PDF, .xopp, and .xoj files. The latter is the format used by Xouranl++'s predecessor, Xournal.

4.2.2 Stimulus/Response Sequences

The user selects `Open`, navigates through their system's file browser and chooses the type of file they wish to open from the scrollbar at the bottom right of the window. After selecting the desired file, the user clicks the "Open" button under the scrollbar, or "Cancel" to cancel their selection. Scrollbar options are: Supported Files, Xournal files, Xournal++ template, Xournal++ files, PDF files and All files. The latter is only for display purposes; if a user selects and tries to open any non-supported format, an error message window will pop up. For all options, the browser only displays files of the corresponding format. It should also be mentioned that opening multiple files at once is not supported; one has to open each file individually at a new window.

4.2.3 Functional Requirements

REQ-1: File selected must be of type .xopp, .xoj or .pdf.
REQ-2: Files can be selected only one at a time.

4.3 Recent Documents

This feature shows a list of files recently created, viewed or edited by Xournal++.

4.3.1 Description and Priority

This feature displays a list of recently opened document in order to provide the user with a quick access to their recent work.

4.3.2 Stimulus/Response Sequences

The user selects or simply hovers over `Recent Documents` and a side window appears, listing recent documents discreetly separated in .xopp/.xoj and .pdf categories.

4.3.3 Functional Requirements

REQ: File selected must not have changed location since it was last opened by the program.

4.4 Annotate PDF

Opens a file browser window for the user to search for some PDF file to open.

4.4.1 Description and Priority

This feature, like `Open`, opens a file browser window at the last used location. The only files available for selection are PDF files. Additionally, at the bottom left of the window a checkbox is used to attach the PDF file to the journal that will be created. When this option is selected, a copy of the PDF file is created at `Save` (see 4.5), saved alongside the journal, under the name %{name}.xopp.bg, where %{name} is the journal's name. This file is generated in order to accompany the journal in future uses, in case the original PDF file gets moved to another location or removed. If the journal has no attaches and its background PDF is no longer found in the same directory, opening it will present a popup window asking whether to use another PDF as background or no background at all. Note that, if the unattached journal is later moved together with the background PDF, Xournal++ will still remember the original location (regardless of the fact that both files currently live in the same directory) and will pop a slightly different window which also proposes the selection of the PDF of the same name in the new directory.

4.4.2 Stimulus/Response Sequences

The user selects `Annotate PDF`, navigates through their system's file browser and select the PDF file they wish to open. The scrollbar at the bottom right of the window has only two options, PDF files and All files. After selecting the desired file, the user clicks the "Open" button under the scrollbar, or "Cancel" to cancel their selection. The selected PDF file opens as a background, as described above. The user can set a zoom tolerance for re-rendering the background from `Preferences < Drawing Area < Cache PDF`.

4.4.3 Functional Requirements

REQ: File selected must be of .pdf type.

4.5 Save/Save As

Opens a file browser window for the user to save their document.

4.5.1 Description and Priority

Both these features open a file browser window at the last used location. The user enters the folder in which they wish to save the document and hit `Save`. In addition, a textfield at the top of the windows gives the possibility to type a name of choice for the file. Default names are of the form %F-Note-%H-%M", where "%F" is a placeholder for date, "%H" for hours and "M%" for minutes. This default format can be customized at `Edit > Preferences > Load/Save > Default Save Name`.

4.5.2 Stimulus/Response Sequences

The user selects `Save`, goes to the desired location, optionally creates a new folder, changes the default name of the document (optional but recommended) and hits the "Save" button. Even for documents that where created as PDF annotations by opening existing PDF files, the only possible format in which the document can be saved is the .xopp. `Save` and `Save As` operate identically at the first save of the document. Their difference is that, if a subsequent save is to be performed, `Save As` will reopen the window to give the user the possibility to save the document as new (with a different name/in a different folder), without modifying the original stored during the first save, whereas `Save` will not open any windows and will automatically update the existing document.

4.5.3 Functional Requirements

REQ: Files must have different names or else the latter will replace the older file of the same name.

4.6 Export as PDF

Opens a file browser window for the user to export their document as PDF.

4.6.1 Description and Priority

The user selects `Export as PDF` and a file browser window opens at the last used location, same as the one in described in the previous feature. The user enters the folder to which they wish to export the document and hit `Save`. The default name is of the form "%{name}_annotated", where %{name} is the journal's name. This can also be customized at `Edit > Preferences > Load/Save > Default Pdf export name`.

4.6.2 Stimulus/Response Sequences

The user selects `Export as PDF`, goes to the desired location, optionally creates a new folder, changes the default name of the document (optional but recommended) and hits the "Save" button.

4.6.3 Functional Requirements

REQ: Again files must have different names or else the latter will replace the older file of the same name.

4.7 Export as...

`Export as...` opens a file browser window for the user to export their document as a PDF, a PNG, an SVG or a .xoj file.

4.7.1 Description and Priority

`Export as…` works as `Export as PDF`, with the only difference being the options scrollbar which gives the user the possibility to export the document also in .png, .svg or .xoj format. At this point it should be noted that save and export are different; a document may have been

exported for instance as a PDF, without having been saved. That is, Save refers to the standard Xournal++ journal format .xopp while Export involves converting and saving only the converted file to memory.

4.7.2 Stimulus/Response Sequences

The user selects `Export as…,` goes to the desired location, optionally creates a new folder, changes the default name of the document (optional but recommended) and hits the "Save" button. If either PNG or SVG are selected, a window opens and the user is asked to determine the range of the pages that will be exported and whether the background will be kept or not. In case of multiple pages, Xournal++ exports them separately, appending "-<page number>" to the file name. For instance a two-page document named "-Note-09-28"will create two PNG files named "-Note-09-28-1" and "-Note-09-28-2".

4.7.3 Functional Requirements

REQ: Again files must have different names or else the latter will replace the older file of the same name.

4.8 Print

`Print` opens a standard system window with printer options.

4.8.1 Description and Priority

This feature sends the document to an available printer for printing.

4.8.2 Stimulus/Response Sequences

The user selects `Print` and a standard print window opens. After selecting the desired options, the user hits "Print". It is important to mention that `Ruled` and `Graph` backgrounds do not get printed (whereas vertical red lined do).

4.8.3 Functional Requirements

There are no requirements in order for Print to operate. It will even print empty and/or unsaved documents.

4.9 Quit

`Quit` terminates Xournal++.

4.9.1 Description and Priority

This feature terminates the current program's window. That is, if multiple windows are open, `Quit` does not affect any of them other than the current one from which it was selected.

4.9.2 Stimulus/Response Sequences

The user selects `Quit` and, if the current document is not saved (or has unsaved changes), a window pops up asking the user whether to `Save` or `Discard` the changes, or `Cancel` the quit. If the document is empty or all changes are saved, the program simply terminates.

4.9.3 Functional Requirements

There are no requirements for `Quit`.

4.10 Arrange

This feature arranges the position of an object with respect to other objects.

4.10.1 Description and Priority

`Arrange` includes options of `Bring to Front, Bring Forward, Send Backward` and `Send to Back`. When two objects, such an image and a stroke are placed in the same area, the one that was created last, say B, appears on top of the other, say A. Selecting A (with the Select tool, see 4.39) and then selecting `Arrange > Bring Forward` will make A appear on top of B. Similarly, `Arrange > Send Backward` will do the opposite. Bring to Front and Send to Back options refer to the general relationship of an object's position with all other objects: if A is sent to back with respect to B, it will appear behind every other object C.

4.10.2 Stimulus/Response Sequences

The user creates two objects or moves them together in the same area of the page (so that a shared area exists), selects one of them using the Select tool and then selects Arrange to determine their respective positions. Once this relationship is determined, it will hold even if the two objects are moved away from each other and back together. If `Bring to Front` or `Send to Back` are opted, this property will accompany the object when it is sharing area with any other object.

4.10.3 Functional Requirements

REQ: In order for arranging properties to be defined, an object must share area with another object.

4.11 Undo/Redo

These features allow the user to undo an action/undo the undo.

4.11.1 Description and Priority

`Undo/Redo` refers to any kind of action that occurs inside the document. Multiple Undo's and Redo's are possible in order to return to older status of the document and back to the current one. When actions are performed, both Undo and Redo update and display last action that was done/undone to inform the user.

4.11.2 Stimulus/Response Sequences

The user performs some single action in the document that wants reverted, so `Undo` returns to the exact previous state, before the action was performed. On the other hand, if the user regrets this revert and wants to get the exact same result that said action yielded, `Redo` can render the document to the desired state.

4.11.3 Functional Requirements

REQ: `Undo` is available only when at least one action has taken place, while `Redo` is only available when at least one `Undo` operation has been executed.

4.12 Cut/Copy/Paste

These features allow the user access the clipboard.

4.12.1 Description and Priority

`Cut, Copy` and `Paste` operate in the standard manner, cutting, copying and pasting objects to and from the system's clipboard. This can be done with practically any object within the document, but it can also be used to import data (such as images or text) from any other interface that uses the clipboard.

4.12.2 Stimulus/Response Sequences

The user selects an object with the Select tool and hits the "Cut" or "Copy" button. Then the cut or copied object can be pasted in the document by hitting the "Paste" button, or it also be pasted to another interface such as a text editor. Similarly, the user can copy to the clipboard an item from anywhere in the system and hit `Paste` to paste it inside the Xournal++ interface.

4.12.3 Functional Requirements

REQ: For `Cut/Copy`, some object must be selected while for `Paste` some object must be already in the clipboard.

4.13 Select All

This feature selects all objects in the current page.

4.13.1 Description and Priority

`Select All` selects all objects in the current page. This does not refer to objects in the background, i.e., objects from the PDF file that might have been opened as a background for annotation.

4.13.2 Stimulus/Response Sequences

The user creates or imports objects in the current page and `Select All` selects them to copy, delete or perform any other common action.

4.13.3 Functional Requirements

REQ: `Select All` requires the existence of at least one object in the current page.

4.14 Find

This feature inserts a search textfield at the bottom left of the window, where the user types the text to be searched for.

4.14.1 Description and Priority

`Find` searches only for typed text inside the document, that is, text that has been rendered with Xournal++'s Text tool or text that has been imported either through a paste operation from the clipboard or the PDF background. It does not capture hand-written text generated with the Pen tool, nor TeX formulas.

4.14.2 Stimulus/Response Sequences

The user selects `Find`, types desired text and navigates through all of its occurrences using the arrows that appear to the right of the textfield. While `Find` captures all occurrences of said text in the current page simultaneously, arrows allow for a navigation through all pages, where Find dynamically captures all occurrences per page. Helpful messages next to the arrows indicate how many times the text was found in the current page, or that no occurrences where found.

4.14.3 Functional Requirements

There are no requirements for `Find`.

4.15 Delete

This feature deletes a selected object.

4.15.1 Description and Priority

`Delete` removes the selected object or group of objects from the document.

4.15.2 Stimulus/Response Sequences

The user selects the desired object/ objects with the Select tool and then selects `Delete` to delete it/them.

4.15.3 Functional Requirements

REQ: `Delete` requires the selection of the object to be deleted.

4.16 Move Selection Layer Up/Down

These features move a selected object or group of objects a layer up or a layer down, respectively.

4.16.1 Description and Priority

When the document is organized in multiple layers, these follow an hierarchy from bottom layer 1, which is the existing, default layer, to higher level layers 2, 3, 4 and so on. Any object created within a specific layer is only visible when this particular layer is enabled, and `Move`

`Selection Layer Up/Down` gives the user the ability to move items to higher or lower layers, respectively. Note that the background is not a layer; therefore the background alone does not hold any data. If no layers are created by the user, every object lives by default in layer 1.

4.16.2 Stimulus/Response Sequences

The user, after having created or imported some object in a specific layer, selects this item and hits `Move Selection Layer Up/Down` to transfer it to the next or previous layer. Multiple applications of these features move the item up or down successively through the set of layers: for instance if an object from layer 1 is selected and `Move Selection Layer Up` is applied five times, the object ascends to layer 6.

4.16.3 Functional Requirements

REQ: `Move Selection Layer Down` assumes that the current layer is not layer 1 (if it is, nothing happens), while `Move Selection Layer Up` is not available when the current layer is the highest.

4.17 Grid/Rotation Snapping

These features enable a snapping mode for all objects.

4.17.1 Description and Priority

When rotation snapping is enabled, rotations will snap to each angle which is a multiple of 15°. Similarly, when grid snapping is enabled, movements will snap to the grid. The grid's size can be configured in `Edit > Preferences > Drawing Area > Snapping`. In the same place one can configure tolerances for both Rotation and Grid Snapping, that is, values determining how close to a fixed angle or a grid point snapping will be triggered. Therefore, zero tolerance means no snapping while rotation tolerance equals 1 means that the object will not be able to be put between fixed angles and will "jump" from one directly to the other. Similarly grid tolerance equals 1 means that the object will "jump" from one grid point to the other.

4.17.2 Stimulus/Response Sequences

The user selects an object (with the Select tool) along with Rotation Snapping and rotates it by clicking and holding the little red square that appears in the right of the selection. Depending on the rotation tolerance, the rotation snaps to certain angles. Note that rendered objects like images or TeX formulas cannot be rotated. Similarly, with Grid Snapping enabled, the user selects and moves the object and the movement snaps accordingly.

4.17.3 Functional Requirements

REQ: Objects must be selected and tolerance must be close to 1 to get visible effects.

4.18 Preferences

`Preferences` incorporates a variety of customization features:

- `Load/Save` includes `Autosaving`, where the user can determine the amount of time before a file gets automatically saved by Xournal++, `Default Save Name` & `Default Pdf export name` (see 4.5, 4.6) and `Autoloading`. When Autoloading is enabled and the user opens a PDF that has been annotated and for which a .xopp journal exists, Xournal++ opens the journal instead. Furthermore, the user may enable autoloading of the most recent file on startup.

- `Input System` includes Input devices, where the user can change the System Aggregated Pointer from Mouse to Mouse+Keyboard, Pen, Eraser or Touchscreen (for tablet devices), and Options for enabling drawing outside of the page, merging button events with stylus tip events and enabling pressure interface (also for tablet devices). Finally, in this tab the user can use the input stabilization algorithm between averaging method and preprocessor and set their parameters of choice. One of these algorithms should be enabled in order to draw smoother strokes.

- `Mouse` includes options for tool selecting through middle and right mouse buttons.

- `Stylus` offers settings for Pressure Sensitivity of the stylus, Artifact Workaround to ignore initial events that might be performed by mistake, options for tool selecting through stylus buttons and eraser, as well as stylus-based eraser visibility.

- `Touchscreen` includes configuration of devices to operate as a Touchscreen, as well as options to enable Hand Recognition, Zoom Gestures, Touch Drawing and Touch Scrolling.

- `View` customizes the visibility of the Menubar, toolbars, sidebars, scrollbars, as well as the style and colors, during regular, Fullscreen and Presentation Mode. `View` also has an option for Dark Theme.

- `Zoom` can adjust the speed with which the zoom responds and also provides an option for setting the calibration to natural size in Display DPI Calibration.

- `Drawing Area` provides options for adding out-of-page space allowing for scrolling outside the page, setting the first page offset in Paired Pages View, deciding whether an empty last page should be created and when, and also whether to preserve the line width of a stroke while resizing it. Additionally, in this tab there are settings for the minimum stroke size that the Stroke Recognizer can capture, options for snapping tolerance as well as for the minimum zoom for which the PDF gets re-rendered to get rid of blur. In `Drawing Area`, there are also settings for ignoring attempted stroke drawing for strokes too short or too brief (from possible random taps), as well as for setting shape modifiers by cursor direction while using drawing tools.

- `Defaults` tab is where the user selects the default settings enabled by the Default button.

- `Audio Recording` includes options to Enable/Disable Audio, choose the Storage Folder and Input/Output Devices, adjust the Recording Quality and manage Playback Settings.

- `LaTeX` provides settings for the LaTeX tool, such as the Default LaTeX Text, Template file settings and Editor settings. Additionally, since a LaTeX distribution must be installed, in this tab the user is recommended to Always check LaTeX dependencies before running, and also to Test configuration.

- `Language` offers language options.

4.19 View

`View` includes the following options for the display layout of the journal:

- `Paired Pages` (displays pages in pairs, starting by either odd or even numbering, see `Preferences < Drawing Area < Paired Pages`), `Presentation Mode`, `Fullscreen`, `Show Sidebar`, `Show toolbars`.

- `Layouts` (`Horizontal/Vertical, Left to Right/Right to Left, Top to Bottom/Bottom to Top`), `Cols/Rows` (arranges pages in columns and rows), `Toolbars` (options for the position and/or components visible in the toolbars, customization options, floating toolbox), `Hide Menubar, Zoom In, Zoom Out, Normal Size, Best Fit`. Especially for the (experimental) `Floating Toolbox,` this is a view mode that minimizes the toolbars' space and instead pops up a toolbox after every click event, providing a quick access to the (commonly) most used tools.

4.20 First/Previous/Goto/Next/Last Page

These features allow for navigation through the journal's pages.

4.20.1 Description and Priority

The user can quickly access pages.

4.20.2 Stimulus/Response Sequences

The user selects the desired option and is immediately directed to the corresponding page. `Goto` also presents a window where the user inserts the number of the desired page.

4.20.3 Functional Requirements

REQ: Page transitions should be meaningful, for instance when at first page one can't use the `First` or `Previous` options.

4.21 Previous/Next/Top Layer

These features allow the user to access the desired layer to work to, in the current page.

4.21.1 Description and Priority

The user can navigate through layers in the current page.

4.21.2 Stimulus/Response Sequences

The user selects the desired option and is transferred to the corresponding layer, which becomes the working layer. Any layer higher than the one chosen gets inactive and hidden, while all lower layers stay in display (see 4.28).

4.21.3 Functional Requirements

REQ: Layer transitions should be meaningful, for instance when at top layer one can't use the `Top Layer` option.

4.22 Previous/Next Annotated Page

These are features specific to PDF files that allow for navigation only through annotated pages.

4.22.1 Description and Priority

The user can quickly access pages they have annotated in a PDF document.

4.22.2 Stimulus/Response Sequences

The user selects the desired option and is directed to the corresponding page.

4.22.3 Functional Requirements

REQ: There must be pages that have been annotated in Xournal++, possibly at a previous session.

4.23 New Page Before/After/at End

These are used to add pages to the journal at a specific place.

4.23.1 Description and Priority

The user can add pages to the journal.

4.23.2 Stimulus/Response Sequences

The user selects the desired option a page is created accordingly. The user is automatically directed to the newly-added page.

4.23.3 Functional Requirements

There are no requirements.

4.24 Duplicate Page

`Duplicate Page` creates a copy of the current page right after the current page.

4.24.1 Description and Priority

The user creates a duplicate of the current page.

4.24.2 Stimulus/Response Sequences

A duplicate of the current page is created and added as the current page's next page. The user is automatically transferred to the newly-created page.

4.24.3 Functional Requirements

There are no requirements.

4.25 Append New PDF Pages

This feature appends any new pages that have been added to the background PDF file, if any (see 4.4).

4.25.1 Description and Priority

In case pages are added to the background PDF file, Xournal++ will not automatically render them and `Append New PDF Pages` must be used to insert them into the journal.

4.25.2 Stimulus/Response Sequences

The user opens the .xopp file, associated with a background .pdf file. Xournal++ renders the PDF pages as in the file's previous state, and the user selects `Append New PDF Pages` to insert the new pages to the journal.

4.25.3 Functional Requirements

REQ: The .xopp must have a .pdf file attached to it.

4.26 Configure Page Template

`Configure Page Template` offers the possibility to customize the page layout (see 4.30) that will be used whenever the user adds a new page.

4.26.1 Description and Priority

The user defines the desired properties for the pages to be added. By default, Xournal++ copies the layout of the current page. This tool offers the possibility to save settings to a file for future use, since one can load previous settings from a file. Add Page's dropdown menu in the main toolbar offers options `With PDF background`, where the user is asked each time to select one the document's pages to serve as the new page layout, and `Image` where the user can load various images from their file system, and is asked each time which one they wish to use.

4.26.2 Stimulus/Response Sequences

The user selects the desired options and these are applied to the all pages that are added to the journal.

4.26.3 Functional Requirements

REQ: Some new page must be added in order to see the effects.

4.27 Delete Page

This feature deletes a page.

4.27.1 Description and Priority

`Delete Page` removes the current page from the journal.

4.27.2 Stimulus/Response Sequences

The user selects `Delete Page`, deletes the current page and is directed to the next one, if any, otherwise if the user deletes the last page its previous becomes the current one.

4.27.3 Functional Requirements

REQ: The journal must have more than one page.

4.28 New/Delete/Rename Layer

These features are used to manage layers.

4.28.1 Description and Priority

The user can add a new layer to the current page or delete the current layer of the current page. Also, the option of renaming the layer is provided in order to assign a meaning to each layer. It should be noted that the hierarchy does not get affected by layer renaming.

Additionally, although the background is not regarded as a layer, it can be renamed in the same manner.

4.28.2 Stimulus/Response Sequences

The user selects `New Layer` and a new layer is added above the current layer. If the user deletes a layer, the hierarchy of all layers above it drops down accordingly. Lastly, `Rename Layer` pops up a text field window where the user types the desired name.

4.28.3 Functional Requirements

REQ: In order to delete a layer, there must be more than one layer in the current page.

4.29 Merge Layer Down

This feature merges current layer with the layer below it.

4.29.1 Description and Priority

`Merge Layer Down` merges the current layer and the one immediately below it into one layer.

4.29.2 Stimulus/Response Sequences

The user selects `Merge Layer Down` and the current layer gets merged with the one under it.

4.29.3 Functional Requirements

REQ: `Merge Layer Down` cannot be applied to Layer 1.

4.30 Paper Format/Color/Background

These features offer a range of properties to define the page layout (see 4.26).

4.30.1 Description and Priority

`Paper Format` includes options for the template to be used (A4, Custom etc.), as well as for the page dimensions and orientation (portrait/landscape). `Paper Color` offers a number of colors for the page, and `Paper Background` gives options for the background's style (Plain, Ruled, Staves, Image etc.)

4.30.2 Stimulus/Response Sequences

The user selects `Paper Format/Color` and a window with all the options/available colors pops up. `Paper Background` opens a dropdown list with all available background styles.

4.30.3 Functional Requirements

See 4.26 for requirements regarding `Paper Background` and the `With PDF Background Option`.

Note: Features 4.31 – 4.47 refer only to the current, active layer unless explicitly stated otherwise.

4.31 Pen

`Pen` is used to write and annotate the document.

4.31.1 Description and Priority

The `Pen` tool is the default tool used for free-hand writing. It provides various options in thickness (from very fine to very thick), mode (standard, dashed, dotted), fill mode with fill opacity options and color.

4.31.2 Stimulus/Response Sequences

The user selects `Pen` along with the desired options and designs by dragging the cursor with the mouse on click.

4.31.3 Functional Requirements

There are no requirements for `Pen`.

4.32 Eraser

`Eraser` erases any annotation or background area.

4.32.1 Description and Priority

`Eraser` has three modes: `Standard` is used to remove annotations and parts of strokes, `Whiteout` erases everything including background areas, by painting a white stroke on top of the area, and `Delete Stroke` removes a whole stroke by just clicking on any of its points.

4.32.2 Stimulus/Response Sequences

The user selects `Eraser` with the desired mode. For standard and whiteout mode, the cursor should move over the area to be erased with the mouse on click, while stroke deletion requires a single click on any point of the stroke.

4.32.3 Functional Requirements

There are no requirements for `Eraser`.

4.33 Select PDF Text

This feature allows selecting text from the background PDF in linear or rectangle mode.

4.33.1 Description and Priority

The user can `Select Linear PDF Text`, line by line, or form a rectangle to select all text in it.

4.33.2 Stimulus/Response Sequences

For line by line selection, the user just clicks from the beginning and linearly scans the desired lines to the end, or double clicks to select the whole line. For rectangle selection the user scans an area both horizontally and vertically. After the area is selected, a tooltip with highlight, copy and other options appears.

4.33.3 Functional Requirements

REQ: A background PDF file must be present.

4.34 Highlighter

`Highlighter` is used to highlight the document. It is similar to `Pen` (see 4.31), only without mode options.

4.35 Text

The `Text` tool is used for text typing in the journal. The user can select a font, size and color for their text.

4.36 Image

`Image` provides the possibility to add images to the document.

4.36.1 Description and Priority

The user can insert images from their file system in the journal. Images can be resized, moved and removed. Among acceptable formats are .jpg, .png., .svg, .gif, and .tiff.

4.36.2 Stimulus/Response Sequences

The user selects Image, clicks on any area of the journal and a system file browser pops up. The user selects the desired image and clocks “Open”. The user can copy the image in place by right-clicking at any of its points.

4.36.3 Functional Requirements

REQ: The type of the image file must be of an acceptable form.

4.37 Default Tools

`Default Tools` sets the default tool, which is pen by default, with its default options in color and thickness. Defaults can be configured in `Preferences` (see 4.18).

4.38 Draw Shape

Draws standard shapes (Rectangle, Ellipse, Arrow, Double Arrow, Line, Coordinate System) as well as user-defined splines. It also includes a `Stroke recognizer`.

4.38.1 Description and Priority

All the shapes offered can be re-arranged in terms of dimensions by the user. Especially for splines, the tool offers the possibility for polygon courses, smooth curves or a combination of these. Stroke recognition is a tool that, when enabled, converts hand-written drawing (made by pen or highlighter) into the nearest shape, if any.

4.38.2 Stimulus/Response Sequences

The user selects a shape, clicks on an area and drags the cursor in a manner as to create an instance of the shape. Especially for circles and squares, one should select the Ellipse or Rectangle shape respectively and draw while holding the `Shift` key. Moreover, if the user wants the application point to be set as the center, they should hold `Ctrl`. These shortcuts can be simulated by simple cursor directions with the appropriate configuration (see `Preferences < Drawing Area < Drawing Tools`). For polygon courses with splines, the user clicks instantly the locations of the polygon's vertices, while for smooth curves the cursor needs to be dragged a little. That is, instant clicks produce lines and prolonged clicks produce curves, and these can even be combined to produce a more general shape. Finally, when in free-hand sketching, the user can enable stroke recognition to automatically convert their stroke into the nearest standard shape. The minimum size of strokes that the `Stroke recognizer` catches can be configured in `Preferences < Drawing Area < Stroke Recognizer`.

4.38.3 Functional Requirements

There are no requirements for shape drawing.

4.39 Select (Rectangle/Region)

`Select Rectangle` and `Select Region` allow for a selection of a rectangle region or a free-hand designed region, respectively.

4.39.1 Description and Priority

In the second case, the area automatically converts to the smallest rectangle region including the selected strokes and/or other objects. The selected region can be copied, rotated, moved or removed. It should be clarified that only strokes that lie entirely inside the selected area are considered selected.

4.39.2 Stimulus/Response Sequences

The user selects the area by dragging the cursor appropriately. As in `Image`, an in-place copy can be made by right-clicking anywhere inside the selected area.

4.39.3 Functional Requirements

REQ: At least one stroke must be entirely included in the area.

4.40 Select Multi-Layer Rectangle/Region

These features operate like simple `Select Rectangle` and `Select Region`, with the only difference being that the user can select strokes from any layer, not only from the current one.

4.41 Select Object

Selects a particular object.

4.41.1 Description and Priority

`Select Object` selects only one object at a time. Objects can be anything within the layer, from a stroke or a shape to an image or TeX formula. The object can then be copied, moved etc. Particularly in the case of moving, if part of the object falls out of the page it does not get lost and can be retrieved by again selecting the object from its visible part and dragging it back into the page.

4.41.2 Stimulus/Response Sequences

The user selects `Select Object` and then clicks on the desired object.

4.41.3 Functional Requirements

There are no requirements for `Select Object`, other than the existence of an object.

4.42 Vertical Space

This tool inserts or removes vertical space within the page.

4.42.1 Description and Priority

`Vertical Space` creates an empty space at any point of the page, by moving all items below it up or down. If these items fall out of the page they do not get lost and can be retrieved by again using `Vertical Space` reversely.

4.42.2 Stimulus/Response Sequences

The user clicks on a positions and drags the cursor up or down to create a vertical space. All objects entirely below this position are moved accordingly.

4.42.3 Functional Requirements

REQ: Items must lie entirely below the point where `Vertical Space` is applied in order for them to be moved.

4.43 Play Object

Plays audio file attached to the object (see 4.47)

4.43.1 Description and Priority

`Play Object` plays audio that has been associated with said object.

4.43.2 Stimulus/Response Sequences

The user selects `Play Object` and then selects the desired object. Its associated recorded file starts to play.

4.43.3 Functional Requirements

REQ-1: The object must be attached to an audio file.
REQ-2: An enabled output audio device must be selected (see `Preferences`).

4.44 Hand Tool

This tool allows for browsing the journal by dragging the cursor.

4.45 Setsquare/Compass

These geometry tools are used for measurements and/or as guides for drawing precise straight lines, vertical lines, angles, circles and more.

4.45.1 Description and Priority

The setsquare is an orthogonal, isosceles triangle-shaped ruler that can measure distances or angles and also serves as a guide for drawing straight lines. The compass is wheel-shaped tool and measures angles, while also serving as a guide for drawing circles, arcs or sectors. All lengths are measured in centimeters and all angles are measured in degrees; length measurements are particularly meaningful when the length on the screen matches the physical length (see `Preferences`). Geometry tools can be used one at a time.

4.45.2 Stimulus/Response Sequences

The user selects one of these tools, which is displayed in the page. The user can then arrange its position (via keyboard, `Hand Tool` or touch control), scaling and rotation (via keyboard or touch control) and start drawing with the `Pen` or the `Highlighter`. Certain actions near

each tool's edges trigger certain interactions, such as snapping to a straight line or creating a radial line from the tool's distinguished point. Either `Setsquare` or `Compass` can stay active in the page without affecting other areas. If they are not longer of use the user must select them again to disable them.

4.45.3 Functional Requirements

REQ: These tools are not page-transferable and must be disabled and then enabled to appear to another page.

4.46 Record/Stop

These features are used to create recordings.

4.46.1 Description and Priority

`Record` and `Stop` give the possibility to record and create an audio file that gets stored in memory (see `Preferences`) and is attached to the objects that were being created during the recording. Both these functions are incorporated in the same button.

4.46.2 Stimulus/Response Sequences

The user selects `Record` and starts creating objects in the journal while also recording some audio, commonly audio notes such as descriptions relative to the objects being created. After the user hits `Stop`, i.e., the same button, the recording is finished and is stored in memory for later use (see 4.43). If nothing is being done in the journal during the recording, the audio file is still created but not associated with anything, so it cannot be played in the journal.

4.46.3 Functional Requirements

REQ: An enabled input audio device must be selected (see `Preferences`).

4.47 Pause/Stop /Forward/Back

These tools are used to pause, stop, go forward and go back into the audio file, respectively.

REQ: An audio file must be being played (see 4.43).

4.48 Add/Edit TeX

`Add/Edit TeX` renders a TeX object or edits an existing one.

4.48.1 Description and Priority

This TeX tool allows for inserting TeX formulas into the journal.

4.48.2 Stimulus/Response Sequences

The user selects the tool and a two-tabbed window pops up. In the first tab `TeX Source` a field is being provided to the user, in order to write their formula whose result is being displayed in the space above. In the second tab `Command Output`, a field shows the output from the LaTeX generator command. After the formula is complete, the user hits OK and the formula is inserted in the journal as an object. The user can later select the object and select `Add/Edit TeX` again in order to edit it.

4.48.3 Functional Requirements

REQ-1: As stated in 2.7, a working LaTeX distribution must be available in the system.
REQ-2: The formula must be correct in terms of TeX typesetting rules.

4.49 Plugin

`Plugin` offers a plugin manager that lists all the available plugins along with basic info and the option to activate or deactivate them. Activated plugins are displayed in the menubar.

4.49.1 Description and Priority

Plugins bundled with the program's installation include the following:

- `ColorCycle`: enables cycling through the list of colors for the current tool by repeatedly using the same accelerator, via `Alt+C` keyboard shortcut.
- `Example`: `Example` does not have any actual functionality for the user, but provides a template to assist in creating a new plugin using its source code.
- `Export`: quickly exports the current document to PDF, SVG, or PNG formats using keyboard shortcuts (`Shift+Alt+P`, `Shift+Alt+S` and `Shift+Alt+N`, respectively).
- `HighlightPosition`: employs the `Alt+X` keyboard shortcut for promptly highlighting the current cursor position.
- `LayerActions`: provides shortcuts for duplicating non-background layers to the next page, hiding all non-background layers except the footer layers, and adding a new top layer on each page.
- `MigrateFontSizes`: facilitates the scaling of font sizes across the document, through the GUI or directly from the menu. This plugin requires the installation of the Lua lgi-module.
- `QuickScreenshot`: employs an external screenshot tool to rapidly capture a screen region using the keyboard shortcut `Shift+Alt+T`. This can be either copied to the clipboard or saved to a designated file. `QuickScreenshot` only supports Linux.
- `ToggleGrid`: provides a shortcut that toggles the page's layout from Graph to Plain.

More information on these and also on other in-progress or third-party plugins can be found in Xournal++'s website.

4.49.2 Stimulus/Response Sequences

The user selects a plugin, restarts Xournal++ and the plugin is now active. For guidance the user can select Plugin, where a list with the plugin's provided functions and corresponding keyboard shortcuts appears.

4.49.3 Functional Requirements

REQ-1: Xournal++ must be restarted in order for the selected plugin to be activated/deactivated.
REQ-2: Some plugins might require a Lua installation in order to function fully.
REQ-3: Not all plugins support all operating systems.

4.50 Help

`Help` and `About` are used to help the user utilize the program.

4.50.1 Description and Priority

`Help` redirects the user to the official website's Help page, while `About` displays all the necessary info about the program, accommodated with links if needed:

Version, Date of Build, GRK Version used, Git commit's ID, Contributors and links to the website, the source code in GitHub and the GNU GPLv2 license.

4.50.2 Stimulus/Response Sequences

The user selects `Help` and a browser opens up on the help page in the website. When selecting `About`, a window with all the information described above appears.

4.50.3 Functional Requirements

REQ: There must be an Internet connection to access `Help` as well as the links in `About`.

5. Other Nonfunctional Requirements

5.1 Performance Requirements

There are no specific performance requirements.

5.2 Safety Requirements

Xournal++ should function even in cases of wrong data insertion or wrong settings, providing users with appropriate help messages in case of errors.

5.3 Security Requirements

Xournal++ does not directly pose any security issues, as it does not contain or manage any sensitive data. It is installed for all users, which may raise some security considerations.

5.4 Software Quality Attributes

Xournal++ is a specialized note-taking tool characterized by reliability, availability and serviceability.

Appendix A: Glossary

- **Annotations**: notes or objects specific to the background PDF document, i.e., underlines, highlights and strikethroughs.
- **Layers**: a mechanism for organizing and managing different levels of content within the journal.
- **Snapping**: a feature that assists in aligning or connecting objects or elements to specific points, guidelines, or grids.
- **Stylus**: a handheld pen-like tool used for interacting with touchscreen devices or digital screens.
- **Stroke**: either a freehand or a hand-drawn line or shape created using a stylus or other input devices. It represents a sequence of points captured as the stylus moves continuously across the input surface.
- **Object**: any entity with which the user can interact as a whole. The term includes strokes, text objects, images, shapes, annotations and TeX objects.
- **TeX**: a typesetting system widely used for the production of documents with complex formatting requirements, such as scientific and mathematical documents, academic papers, books, and technical reports.
- **LaTeX**: a markup language and document preparation system based on the TeX typesetting system.