

A Collaborative Visual Database

by

Imed Adel

A document submitted in partial fulfillment of the requirements for the

degree of

Technical Report

at

MISKATONIC UNIVERSITY

Contents

General Introduction	1
1 Introduction	3
1.1 Preliminary study	3
1.1.1 Existing solutions	3
1.1.2 Critique	5
1.1.3 Proposed solution	6
1.2 Conclusion	6
2 Analysis and specification of needs	7
2.1 Functional requirements	7
2.2 Non-functional requirements	8
2.3 Identification of actors	8
2.4 Use case diagrams	9
2.5 Conclusion	9
Acronyms	10
Bibliography	11

List of Figures

2.1	Example of a parametric plot $(\sin(x), \cos(x), x)$	9
-----	--	---

List of Tables

General Introduction

Software is either slow, hard, or ugly. And sometimes all three. Nonetheless, since the introduction of the modern computer, software has taken the world by storm. And it quickly became an essential component of every business since it paved the way for higher productivity and more automation, and therefore, increased profits.

Nearly forty years [2] have passed since the launch of the Apple Macintosh—one of the first commercially successful [3] mass-produced personal computers featuring a graphical user interface. Yet, software is still as inaccessible and inadequate for most users as ever. Perhaps the best example for such inaccessibility is the fact that this document is being produced using \LaTeX —a fractured software system that requires a plethora of tools to be installed for the sake of producing a legible and aesthetically pleasing document.

Along with the domination of personal computers and software companies in the world, another technology was on the rise—the internet. Since the dot-com bubble in the early 2000s, the internet has reshaped our lives. Be it entertainment, communication, education, or work, the internet is the primary and most powerful medium. Therefore, it is no surprise that most software companies switched to Software as a Service (SaaS), that is hosted software served through the medium of the internet [4]. Which quickly evolved into collaborative software aimed at teams rather than individual users.

The continued sprawl of these technological advancements led to the rise of remote work—a movement that erases any geographical limits and allows businesses and institutions to expand well beyond their headquarters. This move-

ment has been recently magnified to unprecedented levels due to the global pandemic. The main traits of work and education instantly changed and non-collaborative software fell behind to give room to collaborative SaaS.

Within these changing dynamics, managing data is still an unsolved problem. Setting, managing, and securing a database is still one of the hardest tasks of building a business. Connecting the database to the rest of the business' applications is not as easy as one might expect. Keeping all employees on-board and managing access to the database, while allowing everyone to seamlessly collaborate is not easily achievable. Requiring all of the above while keeping the costs low is impossible. Software geared towards managing data and content is either hard to configure and hard to use or slow to load and slow to on-board.

Based on the belief that software must be accessible, collaborative, fast, and hopefully enjoyable to use, we set out to develop a modern alternative. Using the latest technological innovations, our project is pushing the limits for what is possible with collaborative SaaS for managing data and content. Merebase—our project—is a collaborative visual database SaaS that challenges the norms, democratizes access to data management software, and fills the need for a no-code and low-cost database software.

Our work is discussed in four chapters.

- Introduction is an introduction.
- Analysis and specification of needs is an analysis.

1 Introduction

The world has been seeing a continuous shift to remote work since the internet boom in the early 2000s. The recent global pandemic instantly boosted the number of remote workers to unprecedented levels. On top of that, businesses have been gradually moving away from brick-and-mortar stores to online software-managed ones. Furthermore, client-side web apps and no-code web apps and websites have experienced a surge in the number of users. These factors uncovered a gap in the niche of easy-to-use collaborative data and content management software.

And that's how it works. Next, what? [1]

1.1 Preliminary study

In order to better understand users' needs, we have to explore the existing solutions and their shortfalls.

1.1.1 Existing solutions

A plethora of solutions in the niche of data and content management software exist today, with each having its own focus and its own distinctive use.

Notion.so

Notion is a new contender in the space of content management. It presents itself as a collaborative workspace for teams. Its use cases vary from product

1 Introduction

management and team documentation to note-taking and personal organization. The initial version of Notion was released in 2016. The second version, which received a lot of praise and media coverage, was released two years later in 2018. However, the largest surge in signups happened during the pandemic, with 40% of signups occurring from December 2020 to January.

Notion.so is built on the concept of blocks: A block is any single piece of content you add to your page, like a to-do item, an image, a code block, an embedded file, etc.¹ This makes it easy to build complex pages and move content around.

Notion is also built as a collaborative web app—eliminating the need for saving and figuring out how to share one’s documents as is the case in other apps.

Pricing is done per workspace member with unlimited storage starting from the free plan.

Airtable

Airtable is a visual database app inspired by the ease of spreadsheets and the wide adoption of software like Microsoft Excel. The company behind the app was founded in 2012.

Airtable comes with team collaboration out of the box. It also automatically generates a REST API from each database.

Pricing is done per team member. There are several limits to the size of storage and uploads.

Contentful

Contentful is a headless² CMS (Content Management Software). It offers a flexible CMS editor and a configurable API. It also comes with multiple SDKs

¹citation needed, see Notion FAQ

²Content is decoupled from the main application. It’s made accessible through a set of APIs.

(Software Development Kits) in multiple programming languages to make its integration easier.

Pricing is offered per package, with the lowest premium package starting at US\$489 per month.

Sanity.io

Sanity.io is another headless CMS. It competes directly with Contentful, offers an even more configurable editor, and its pricing starts at US\$199 per month. It comes with real-time collaboration, a feature that Contentful lacks.

Webflow CMS

Webflow is a website builder. It bundles a CMS and an e-commerce management system along with its visual website builder. The CMS is not usable outside of Webflow websites, however, it comes with an intuitive user interface.

Firebase

Firebase is a platform developed by Google for creating mobile and web applications. It was initially released in 2012. It offers, among its products, a real-time database. In which, data is stored in JSON format and synced between all the connected clients. The database was not developed with non-technical users in mind, however, its real-time capabilities offer an example of what's desired in real-time database software. Firebase Realtime Database has been successfully used to develop highly demanding mobile applications.

1.1.2 Critique

Multiple solutions are trying to focus on various use cases, however, all of them suffer from noticeable performance issues, a bad UX (User Experience), and inadequate pricing for small and medium-sized businesses.

1 Introduction

Notion is known for its slow performance and long loading times. Pages take on average between six and 12 seconds to load.³ It also doesn't have an API, although one is being developed at the time of writing. Furthermore, Notion is less structured than products like Airtable or Firebase.

Airtable is notable for its complexity, even for experienced users. It also suffers from some performance issues when loading large documents. Furthermore, it doesn't have the same rich text capabilities as Notion. Finally, it lacks a real-time API and it's relatively expensive.

1.1.3 Proposed solution

Merebase is a collaborative visual database that can be used for data and content management. It's built with real-time collaboration, performance, and intuitiveness in mind. Thanks to years of innovation in the field of browser apps and high-performance real-time servers, it should be able to load instantaneously, while offering a smooth user experience with no glitching or slowdowns when loading large documents, and with the ability to effortlessly collaborate with other users.

1.2 Conclusion

The recent changes in workplaces and software development require robust collaborative and intuitive visual database systems, which we currently lack. Merebase is a proposed solution for these problems, built on top of cutting-edge technologies to offer the best user experience possible.

³citation needed

2 Analysis and specification of needs

Researching the current solutions led us to formulate a set of requirements to ensure that Merebase offers the best experience.

2.1 Functional requirements

- A user must signup and login using only their email
- A user's account picture is fetched automatically from Gravatar
- A user can create a maximum of 20 workspaces ¹
- A user can invite other users to their workspace using their email
- A user can create new projects, columns, and rows
- A user can query the database using a REST endpoint and a Websocket endpoint
- A user can upgrade their account to a premium one
- A user can cancel their premium subscription
- A user can edit the same document as other users at the same time

¹This is a technical limit imposed by Stripe, the payment processor

- A user can define the column data type (text, number, boolean, etc.)

2.2 Non-functional requirements

- The web app should load within milliseconds
- Browsing large documents should not result in glitches or lags
- The interface should be accessible and intuitive
- Private documents should remain private and inaccessible to hackers
- The web app and the real-time server should be always available

2.3 Identification of actors

Merebase uses RBAC (Role-Based Access Control) to manage users' access levels and permissions. There is only one actor, the user, but with multiple assignable roles.

- Owner: The user who created the resource, be it the workspace or the project. This role gives you entire access to the resource and it is assigned automatically.
- Admin: This role gives non-owner users the same privileges as the owner. Admins can invite new users and assign roles.
- Editor: This role permits a user to edit documents in a workspace.
- Viewer: This role permits a user to view documents in a workspace, without the ability to modify them.

2.4 Use case diagrams

To better illustrate the main interactions between the user and the application, we rely on a use case diagram.

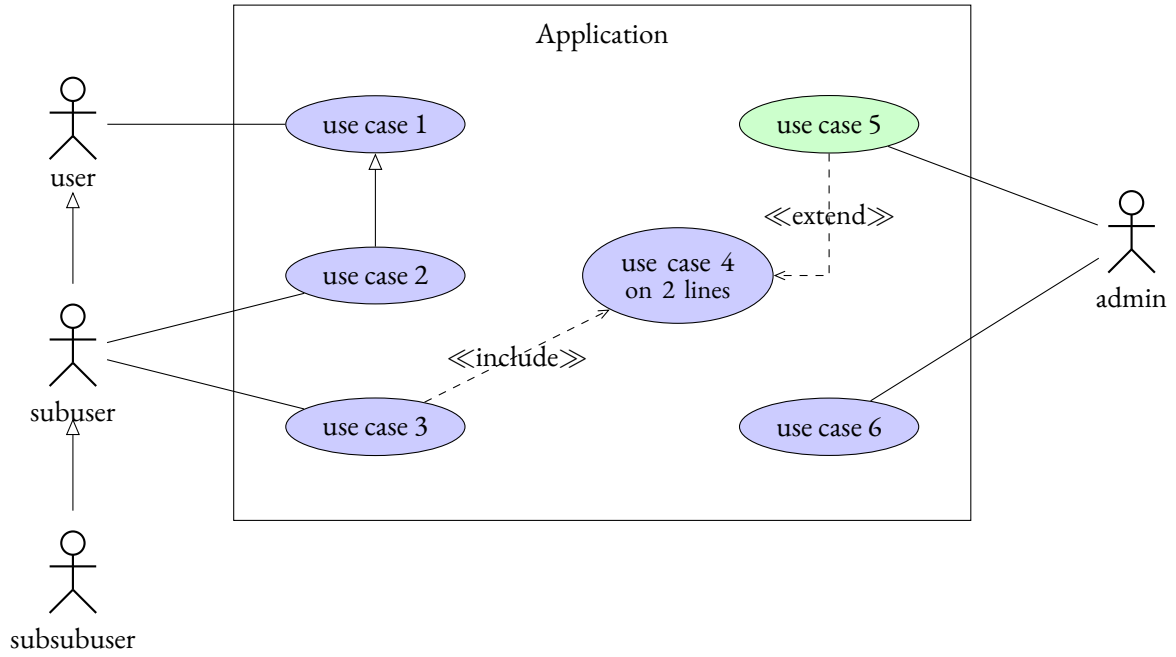


Figure 2.1: Example of a parametric plot $(\sin(x), \cos(x), x)$

2.5 Conclusion

TBD

Acronyms

SaaS Software as a Service

Bibliography

- [1] R. Bringhurst. *The Elements of Typographic Style*. 4th ed. Vancouver, British Columbia, Canada: Hartley & Marks Publishers, 2012.
- [2] *Macintosh Product Introduction Plan*. July 2010. URL: <https://web.archive.org/web/20100721013724/http://library.stanford.edu/mac/primary/docs/pip83.html> (visited on 04/01/2021).
- [3] K. Polsson. *Chronology of Apple Computer Personal Computers (1984-1985)*. Aug. 2009. URL: <https://web.archive.org/web/20090821105822/http://www.islandnet.com/~kpolsson/applehis/appl1984.htm> (visited on 04/01/2021).
- [4] B. Turner. *What is SaaS? Everything you need to know about Software as a Service*. en. URL: <https://www.techradar.com/news/what-is-saas> (visited on 04/01/2021).