## VIRTUAL COMIC BOOKSTORE WEB COMIC DATABASE

Streaming is now the predominant form of entertainment, we watch films on Netflix rather than on DVD, listen to music on Spotify rather than CD, read books on a Kindle rather than handle a physical book and now we can read comics in the same way. Marvel and DC both offer subscription services where you can read current issues and a large selection of back issues. There are a few sites where comics can be downloaded for free, but I will only list the ones with public domain titles. Comic Book Plus has a large selection with over 40,000 public domain comics and the Digital Comic Museum also has a large selection.

Digital comics are available in a variety of formats, including PDF and archive formats where each page is scanned as a separate image. Most comic books are now available digitally, and this is an attempt to present your collection in a more traditional format, as well as providing a full archive. In a library, the books are laid out using Dewey Decimal code but comics are normally arranged alphabetically and chronologically. New comics are released every week and the current comics which are traditionally covered dated with the current month, are on the shelves and back issues are arranged in long boxes chronologically with dividers separating the titles.

The idea is to model your collection as though you were in a comic book store, although with some additional features to allow you to maintain a reading list, rate comics, and other ones that only make sense such as downloading comics from the web. Digital comics are stored in 3 main formats, cbr and cbz which is either a rar file or zip file containing jpg scans of each page, or as a PDF file.

Browsers normally support PDF but do not support cbr and cbz files, so the server will extract the images on demand by getting the filename from the request.

Data will be stored in an SQL database, SQLite which is included in Python is the easiest. The data is stored in multiple tables, with story being the main entity. A comic normally contains 1 story and sometimes a backup strip. The attributes for a story are the artist, inker, writer, plot, color, letters, characters, title, part number (not always applicable), and the number of pages. A comic consists of a cover and a series of pages, non-story pages include adverts, text features and letters pages. A possible

extension would be use perceptual image hashes to detect repeated pages, so you could automatically identify adverts which would be single pages that appear in multiple comics, but also stories that have be reprinted in a trade paperback. As comics are indexed a small thumbnail image is saved of the cover to save having to extract the cover on demand, the number of pages is also determined at this time.

This is not the end of the application, I am using this as a basis for my VR assignment as well, and that will run on the Oculus and use the PC to act as a server. The Oculus Quest will display the comic store in 3D and allow you to view a comic, and turn the pages, if possible, with hand gestures but if not by using the controller. It should also be possible to present the 3D view on a normal browser using WebGL and Unity.

Viewing a comic will use a single page at a time view, and possibly a sliding view point which identifies the panels and displays them in order, this would be controlled by a series of coordinates of each panel and these files could be shared with others, and can be embedded in the cbr or cbz files or present as an external cbk file (which would be a json file) containing details of the comic. An extension would include the ability to hotlink, so if there is a panel saying "see Previous Issue" or "see Comic #234" then clicking that would open that comic. By default, once you finish a comic, clicking on next would take you to the next issue, but you can specify an alternate link if there is a story that continues in another title.

The only alternatives are DC and Marvel subscription services which charge a fix monthly fee in order to view comics, and only have a limited selection, especially among the older back issues. This provides a permanent library, and does not require monthly payments. The sites I listed at the start have a large collection of public domain comics, but avoid comics published in the last 50 years. The GCD (Grand Comics Database) is the resource for details of almost everything published, but does not allow you to view them.

Using the Pony ORM means we automatically have the Model part, as each table in the database is represented using a class. Bottle provides the View part, as it renders the HTML mixed with the requested data to the browser from template files, and is responsible for calling the Controller which lives in server.py and that decides which data to access.

It uses multiple inheritance to reduce the amount of code, and the main application is under 500 lines due to this. I created a Page class that forwards the requests to dunder (double underline) methods, for get and post depending on the type of request.

The program is written in Python, and uses Bottle (for webserver), Pony (for database), Rarfile and Zipfile to access the contents of CBR and CBZ files using a proxy class that can handle them both the same. It also uses Pillow to generate the thumbnails. The website uses Jquery and Bootstrap for Javascript and CSS support, along with lightGallery to provide the comic slide show.

Now day people spend more and more time on computer, and digital publish book also be more and more popular, at past people loved to go to comic store and choice the books we want to read, but because of the limit of the Physical commodity selling model, the comic book could be out of stock or delay from store, that make come customer can't enjoy what they want to read when they went to a comic store. Also, in this situation that the Covid-19 is out there everywhere and people are preferring a non-contact way to get what they need, and the customers also worried the safety of the book that touched by somebody else. An online comic book store will be not only not only solved the problem of out of stock and transport delay that could have, but also removed the possibility that contact Covid-19 or anyone carry it. An online comic store also has other benefits because the property of digital book. Such as digital book is more environmentally friendly than a traditional physically book, because digital product doesn't need trees in its production process, and also if you finished one original digital file, you can simply make any copy you want without any cost. Also, a physically book will be damaged every time you open and turn pages, this damage could be severely depending on the quality of the comic book you read, but no matter in what situation this damage can't be avoided. So, a

physical printing comic book will be unreadable at last, but digital comic book won't have this trouble. So, the digital comic book will only more popular than before, and it have a huge potential never before, that make me have a huge confident on this project that could make a success.

To figure out what can be benefits in our project, we need to figure out what the digital comic book store looks like. Because of the digital publishing is still a new thing in our history, we can say that the digital publishing is far from complete and universal. The publishers just simply scan every page of the original painting on computer, and published online. And those comics are just be treat as a low-cost version Substitute product of physical printing comic books, and it's not design for online reading only, that lead us to a problem that is the online reading experience is not same as we read a physical printing comic book. Also, it's extremely different that we show a comic between on website and a real book. Let us see an example first. The follow picture is cut from an online comic website named comic plus [1]



This is a typical online comic reading website with a typical webpage design, that is showing one page of the comic start from the cover page, when you put the next button, the website will load the

next page of the comic and in similar way you can control what page you want go by the button it shows, which is good design but it also makes a problem that is the habit people read online is different with in real book in this way. For a physical printing book except the cover page and the bottom cover page, every pages else are actually be paired side by side, that's means every time you flip the page it's not showing only one page but two new pages on your eyes, so reader always reads things two pages in one flip. This is a habit that keeps in human beings hundreds of years reading history since we start product books, so it's something hard to change, that the online comic reading will cause inconvenient to most of people. For examples when the reader finished read the first page of the comic and flip to the second page, on this webpage, it will turn the first page to the next page, so you can't read the first page and second page at same time, if the second page is related to the first page, you can only click the "previous page" button and turn the page to previous page, sometime you even need to do this for several times which will cost time and affect your reading experience in bad way seriously.

In our project we are focus on restoring the experience as reading a physical printing book, we build models for every books so that you can flip the comic book in our project as the same way you flip it at real world. You watch the cover page first and decided to open it or not, you also can simply turn the comic book to the back cover to confirm the publishing information and the price, also for some of the book the short review in word is also at the back cover page, so reader can have a basic understanding of this comic book before they open it. This is benefits compare to the existing solution because the most online publish comic is not create for online only, the people who write and edit the book are using the way to create a physical printing book, so it's better to have the same experience between read online and offline will be better and convenience for both reader and publisher.

Another point is what kind of device that reader uses to read the digital comic online, for most of time, people want to read it by using smart phone or other reading device such as kindle, but at the same time, there are still some of the readers that hope to share their opinion reading with their friend at the same time they read the comic, at this situation a website that only convenience on mobile device

will be not convenience as they should be. As showing in the picture of the comic plus website, we post above, you can see that for most of the comic website is designed for mobile device read first the design is comfort for those devices but not on computer's web browser or another device. In our project, we are trying to making the reading more fit or non-mobile device so that people can have a unique experience on review a comic book and you can share the comic you current reading to your friend more convenience with your friends using the same device you read the comic, it won't taking your time to do it, so you won't be interrupt from your reading. Also, the design is based on VR device design so if you are using a VR device to run the program, you will be having the same feeling as you are in a real comic shop, that is the benefit that most online comic store can't give to you.

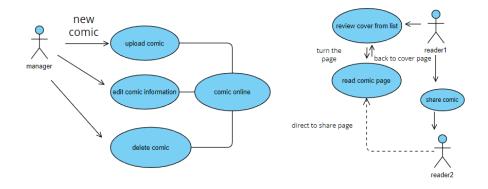
There will be two kind of user roles that will join the active of our project, they are manager (editor) and reader. For these two user roles their required different functional requirements in our project.

The manager is who managed this virtual comic store, the manager's role is to keep uploading new comic book to the comic store and the information of those comic book be correct, so it won't cause any trouble. So, for this user roles, they request upload, delete and edit function. Upload function is to upload a comic as you need, after manager scan the comic for the physical carrier (book or original paint), they will need to upload it in to the database and post it on the comic book store, and the book page should have the right order as its be uploaded, and also the manager should be allowed to upload the detail of the books in the comic store, such as the writer information and publish information that a book should have. Also, manager should able to delete a comic from comic store if they want to, there could be some situation happened and making a comic book is no longer should be published or simply the manager upload more than one of the same comic books in accident so we just need to keep one in our book store and removed the other. The remove function should allow manager to remove the book from comic store completely, not only remove the book from data base but also can't have empty object left in the comic book store. The edit function should allow manager to edit the

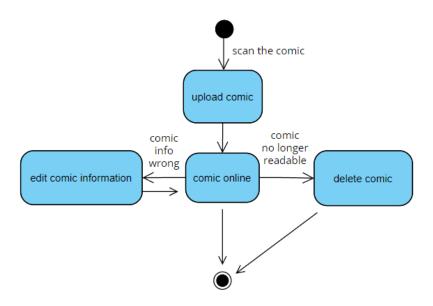
comic book and its detail information. It should allow manager to swift the page that upload incorrect and allow to correct the mistake information for this book.

The reader is who visit the comic book store and read comic. The reader will read the comic and share it with other people, so the function requirements are check cover, turn the page, share with other people. Check cover is the function that allow user to see the comic books cover, the cover is the most important part of a comic book, it can give the reader a first image before the reader open the comic book, there for the reader should able to check the books cover clearly just like the comic book is be put on a book case in real comic book store. Turn the page is that reader can flip the book page to next page by using button on webpage or using hands gestures on VR device. Share function is also an important function for reader because people always love to share what they like with other people, this function should allow user to location which comic book and page they are reading, and they can share the location information with other people.

The following is the case diagram for two user roles.

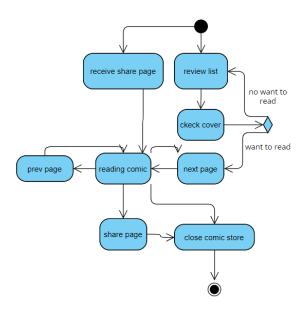


For the manager roles the activity diagrams show below.



When the manager receives a comic book, manager will scan the comic book to the form that can be upload to database, then manager will upload the comic and its information to the comic store. If the comic info was wrong, manager can edit and renew the information and the comic will be online again, is comic is no longer readable, manager can remove the comic from comic store and then this comic will delete completely.

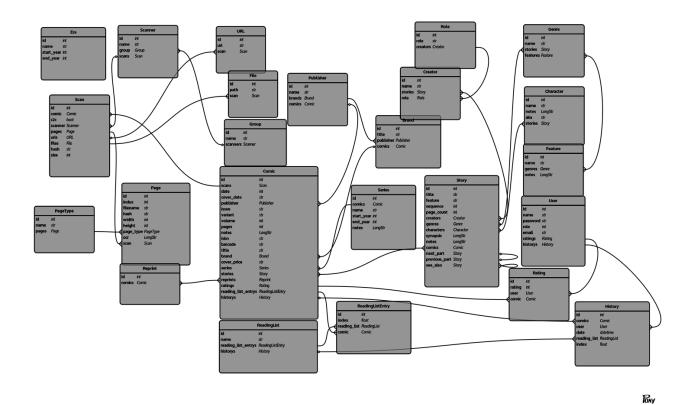
For the reader roles the activity diagrams show below.



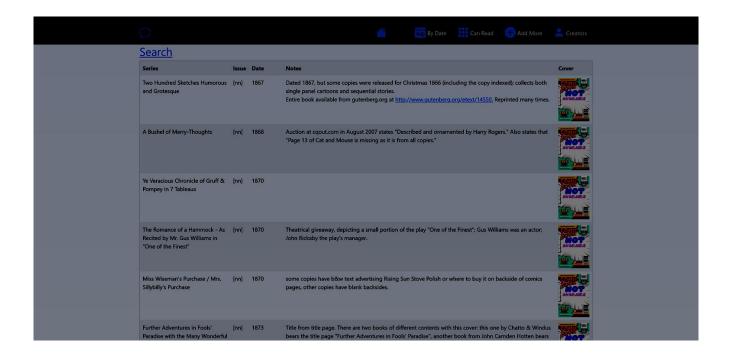
From the activity diagram we can see that, if the reader in to the comic store, at first readers will see the list of all the book, and readers can check the cover as they want to find the comic that they have interest, if they have interest, they can flip the book to next page. When reading a book, readers can control to go next or previous page, and their can also share the location of the book to another user. That's means who received the share information can go to the shared comic page directly.

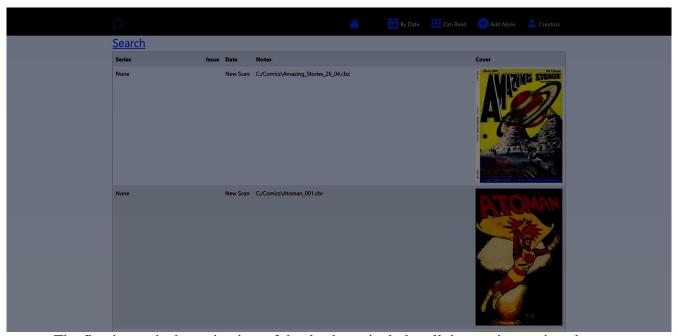
The three different qualities in our project, Correctness, Time-efficiency, and Robustness. All of the three qualities are important. First at all, the correctness, when you are manager, you upload the comic and it publish information with it, you will want to make sure the program uploads your comic page follow the order you upload so the page order will be correct otherwise the comic page will be in out of order and unreadable. Also, if the program has no correctness, from the cover page might not lead you to the correct direction. In our share function, we need to locate the current page first and share the locate information, but if the program lacks the correctness, the shared information might lead the user to a different direction. Time-efficiency is also important for our program, most of the user using the program to read comic books is for chilling, that means they are using them precious rest

time, there for they will not willing to spend long times on searching what they want to read. Also, when you read a comic, you will always want to finish it and don't want to be forced be stop that make the time-efficiency important to make sure that the reading experience be almost uninterrupted. Also, for manager to post the comic faster means that reader can read it earlier that will give you an advantage compare to another online comic website. Robustness is important, because having robustness, means you can allow user making mistake. If you are a manager, you could upload the comic page with the wrong order, but if our program have robustness, we can just change the order without delete the entire comic books. Same as having wrong comic publish information, the manager should be allowed to just renew the information, and for a comic in the store but you don't want, the manager should able to delete it easily. For the readers, if they accidentally turn the page, they should always be allowed back to the latest page as they want. Also, if they accidental closed a comic book, by robustness, the reader should able to re find the book they closed, without spending too much time or search from the start.

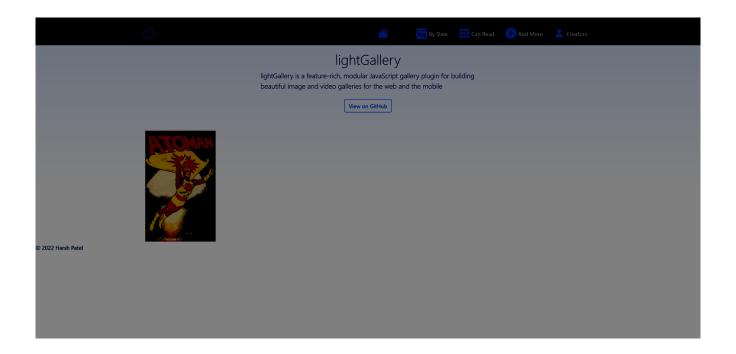


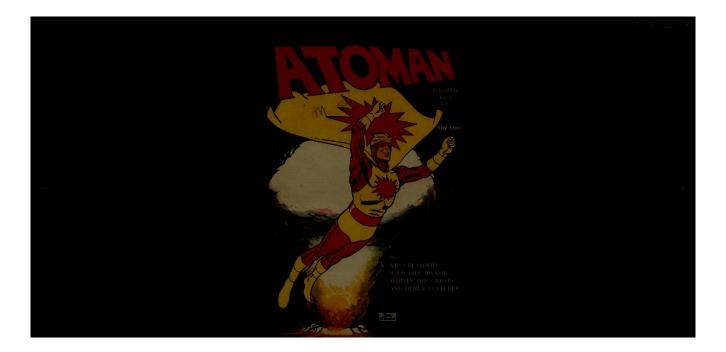
Database tables, as you can see it is quite a complicated schema but this is a vast simplification of the GCD database. I don't keep details of non-English comics, non-comic work done by the authors, and it also does keep track of the printers.





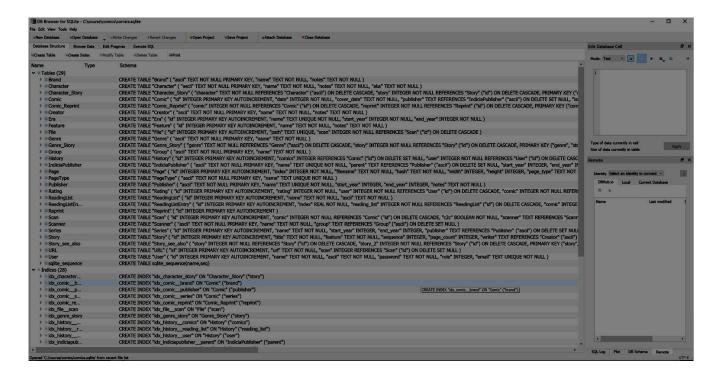
The first image is the main view of the database, includes all the comics not just the ones we have on hand, and the second image is the first few comics where we have the comic on hand. The cover is automatically extracted from the archive to make a thumbnail.

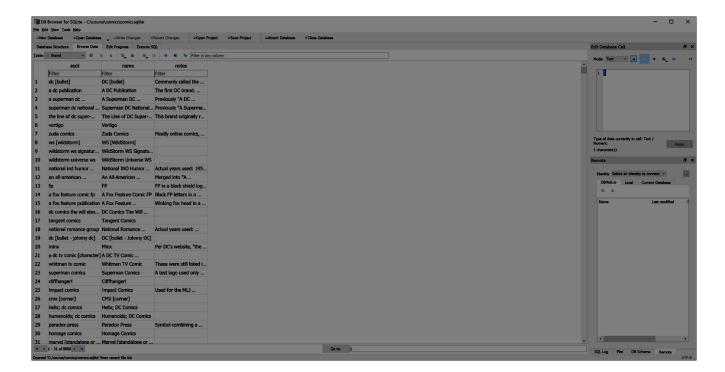


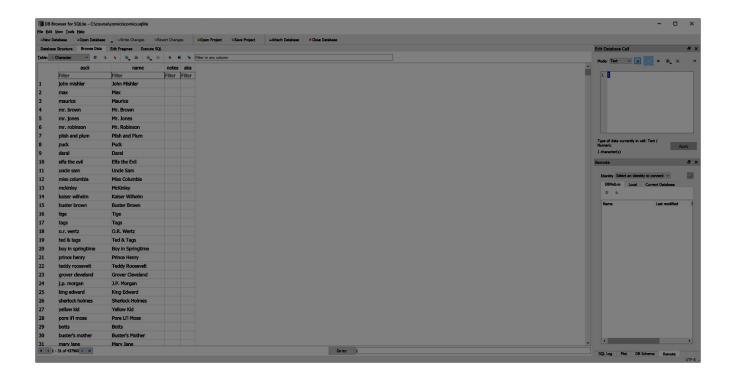


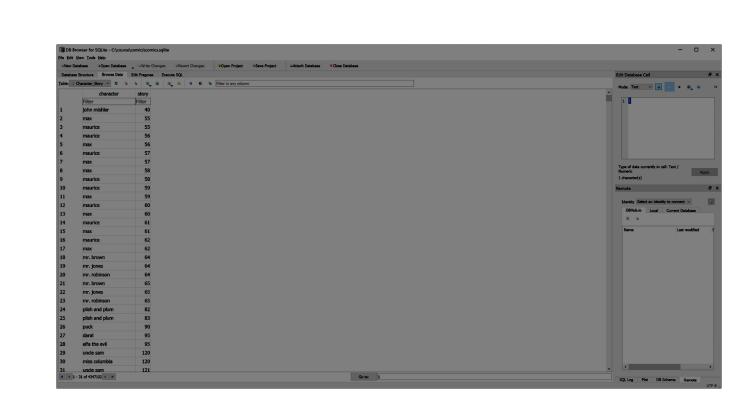
Clicking a thumbnail takes you to a gallery, and then clicking on the cover allows you view the comics using a full screen image slider.

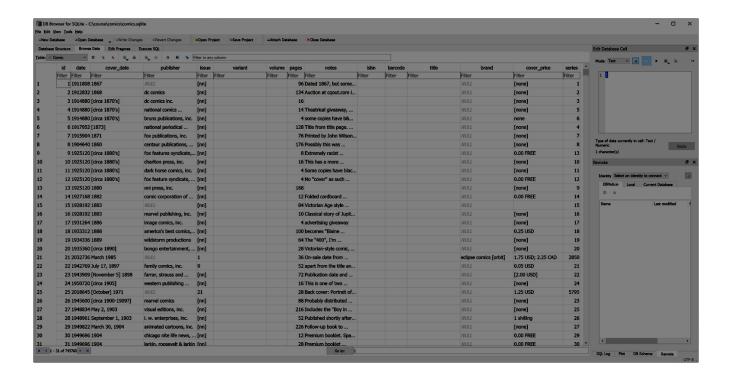
Database tables, only the first entries are displayed, and only for the tables with data (some tables are empty, for later use).







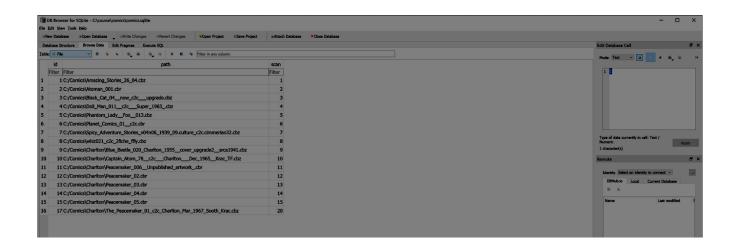




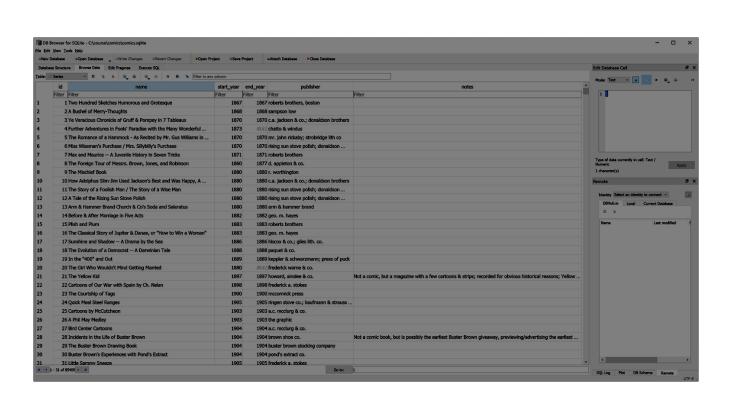














## Work Cited

[1] Comic plus, <a href="https://comicbookplus.com/?dlid=33179">https://comicbookplus.com/?dlid=33179</a>.