Web based tool for Chinese character evolution

Final Report

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1. Project Background

Nowadays, China is becoming more and more important to the global market and is attracting a lot of foreign visitors and immigrants. Chinese, the language which is spoken by the largest amount of population, is also becoming more and more important to the modern society.

However, do not like alphabetic writing such as English, Chinese is a kind of Hieroglyphic. It is seen as one of the most difficult languages in the world, especially when learning to read and to write. Do not like English dictionary, when meeting new Chinese characters it is not an easy task using a Chinese dictionary, and thing can be even worse if the character is on traditional paper medium and they cannot copy and paste it onto Google.

When meeting unfamiliar Chinese characters, though may not know how to read it or what's its meaning, people may know part of the words in most of the times. And during this project we are going to design a website based tool which can help Chinese learners search and learn
Chinese characters conveniently. User can search by any part they know, even only a line which is a basic part of Chinese characters. The website can show characters which contain the part user known, meaning of the character and how to use it in their daily life. Also the website offers knowledge and information about the structure of Chinese characters and the relationship among different words. Target users of this website are those who learn Chinese as a second language and want learning to read and to write, as well as those aims to offer simplified and convenient Chinese character learning service.

There are some web platforms offer Chinese learning services, but yet none of them are exactly the same. For example web platform such as ‘www.zhongwen.com’ works like a dictionary which is not easy to understand or use by foreign users. And other websites such as ‘www.yes-chinese.com’ offer tutorial which helps learn Chinese. However, our product is aiming to help those foreign Chinese learners instead of teach them, and this is a new kind of service which does not have many competitors.
2. Objectives

The objective of our web application is to help foreign Chinese learners and provides consulting services, and our target users are those who learn Chinese as a second language, not only including visitors and immigrants, but also those who are interested in Chinese characters.

Our team will develop a scalable and reliable system to fully fulfill the potential demand. Our product could be divided into user-side and management-side. For the user-side, we will deliver a web platform which can let user search Chinese character they want to know by inputting any part they know, or do the searching just like look up the word with a dictionary. The web platform will provide the Chinese characters which contain the input component, and will offer its meaning and how to use this Chinese character.

And I don’t want this application work as a static dictionary which may be too boring and not interesting enough, I want the users have an ability to communicate with each other and interact with this tool, so I want to let this web platform provides the function which works like
Wikipedia. And if user finds that the character has a new meaning in the modern society, or they had seen some interesting words contain a certain character and they want to share it online, they can do the editing and by the approval of the web site administrator they can put their finding on to the website. The website can record registered users record and the cover page will provide the most commonly used which can help user find what they need easier. What’s more, the website will contain some interesting videos or stories which can attract more users which are interested in Chinese characters.

By implementing my product, I hope users can benefit from that. The time cost of searching Chinese characters could be decreased, and the searching history can help user easily revised what they have searched before. Users can also comment on each word and leave their ideas.
3. Project Analytics

3.1 Literature review

I was born in China and proud of my culture. And as a computer science student, I’m thinking what I can do to help spread the culture of my home country. Nowadays, China is now becoming more and more influential in the global market and there are lots of foreigners come to China each year. Hong Kong is one of the largest international city and lots of foreigners here are learning Chinese, and it will definitely help a lot if there can be a tool which can be used to search the meaning of Chinese Characters and how to use them for Chinese learners.

Although there are already some Chinese learning tools or websites on the internet, they do not have the similar functions as this project. Some websites work as tutorial, user pay for tuition fees and the website will let someone teach them or offers e-learning lessons.
Second types of tools works like translation software, user can search based on the meaning of Chinese words or characters. But this kind of tools only offer basic translation functions and still user may not know how to use the Chinese characters and words they searched, and when user meets unfamiliar characters on newspapers or books and they are not sure about the meaning, this kind of tools may not be useful enough.

Third type of tools works like dictionaries and user can search words based on different properties of Chinese words and characters, and some of these tools also show how to use these characters. However, although sounds like that this kind of tools offer similar function as this project, there is still one important difference which makes this project different. Most of these online dictionaries target to those who already familiar with Chinese, though some of them offer English version, it is not a easy task for beginner use this kind of tools.
3.2 SWOT Analysis

As mentioned before, in this project I am going to develop a web-based tool which can help search and learn Chinese characters easily and conveniently for the foreign Chinese learners. In the following I will use SWOT analysis to analyze the project against its competitors.

3.2.1 Strength:

I am a Chinese student and have computer science background, so I know both Chinese and how to implement what users required. Since I am in the one-man company, I can cooperate with users directly and make improvement directly.

And compared with competitors, the search algorithm is based on the structure of Chinese characters which we will explain later, but not the meaning of characters. So even user meets unfamiliar characters and words on books or newspapers and they don’t know the meaning, they can also benefit from this tool easily and conveniently. And they can
share their ideas which makes this tool an communication platform, but not just a static dictionary

3.2.2 Weakness

Since I am a one-man company, it takes me a lot of time to handle everything, including UI design, database management and function updating. The size of dataset is limited and only included most commonly used characters, and still lots of data needs to be imported. Also the design of the tool is plain but not attractive enough.

3.2.3 Opportunity

The university Hong Kong is one of the best international universities which have lots of foreign students and exchange students, and since it is required to take an Chinese course for foreign students in the university of Hong Kong, the tool this project provided have lots of potential users.

And with the development of China, there will be more foreigners tries to learn Chinese, and the demand of this kind of tools could be increased in the future
3.2.4 Threat

Nowadays the web based tool this project provides do not have many competitors which offer similar function. But if in the future such kind of competitor arises, the tool may lose users. And it takes time to maintain service as well as developing new functions, since I’m a one-man company, I may not have enough time and labor handle everything.

In conclusion, in order to make this web based tool attractive and competitive, I should find ways to handle weakness and threats as well as take advantages of strength and opportunities. I believe this web based tool really has lots of potentials and in the future this tool will be better and attracts users.
4. Project Methodology

4.1 Font-end Application Design

The font-end application is developed using HTML5, PHP and Javascript. In order to construct the web based tool, first I constructed a prototype version of the website, aim to see whether the prototype satisfy the requirements of users. And after testing of the prototype version, I connect the prototype website and database by implementing API on to it.

During the prototype design phase, a set of prototypes was defined and scheduled, and the schedule was strictly followed. After analyzing requirements, the development process went into a loop, which iterates through system analysis, design, implementation and prototype testing and evaluation until the last version of prototype is finalized. This step helped me checked whether the website I constructed is easy to use or not and solved technical errors.

After constructed the prototype Font-end application, I connected it to the database by API I constructed which I will explain later. In this stage,
I checked whether the API can work as expected, and the performance of the website when multiple users use the tool in the same time. Also I modified the user interface design as well as some preliminary design. I will explain the tool in detail in the following part.
4.2 API

PHP is used to construct the API, as PHP is free, open-sourced, fast developing programming language. And it also has a large community. The API can let users get information from the database, add or delete entries as well as modify the data inside database.

The APIs this project use contains different parts. The following is the detailed API file for the project

database.php contains the information about the database, including the database server, username, password and table names. When connect to database this file will be included.

url.php contains the links of each page, and when adding hyperlinks this page will be included. This page can help improve efficiency when adding new page or move the position of existing pages
addtodatabase.php, finishmanagement.php, handleaddcontent.php and handlecomments.php help insert data into database, different API file is used for different data table.

handledelete.php can delete data from database, when deletion happens, this API file will be included

handlelogin.php and handlelogout.php will be included when log in and log out happens, and can modify the data inside database.

Handlerregistration.php is included for new user registration, and can insert data of registration into database as well
4.3 Database

SQL is used to develop the database in MySQL system. MySQL is open-sourced, free, and quite robust. Also, it has a large community already, so it is easy to find support. For this project, the database server is hosted on Sophia.cs.hku.hk.

Since I am a one-man company, the time and labor is limited as I mentioned before. I can only guarantee that the most commonly used Chinese characters are inside the database and the data structure can support operation of the web based tools. In the future definitely I will improve the data structure and enlarge the datasets. Since it is impossible for me to input everything myself, I used reference data from other non-commercial website. I imported data from www.zhongwen.com which is a website works as a dictionary, and has meaning of each Chinese character and how to use them. The detail information will be provided in the following parts.
In the next part, result exhibition, tables inside the database, and I will explain the data contained in each table in detail and show the structure of them each by each.

The table hanzi collect the information about Chinese characters, and table hanzilinks contains the hyperlinks to www.zhongwen.com of each characters. Table visitor contains the user information of registered users and collection table has the history of each users. Comments table covers user comments of each Chinese character. Last but not least, when user cannot find the Chinese character he/she is not sure and what to alert the situation, the argument will be saved inside this form.
4.4 Searching Algorithm

As mentioned before, the distinct algorithm the web based tool provide is based on the structure of Chinese character and the relationship between different characters. Chinese is a kind of Hieroglyphic writing, and a character can be separate as different parts, and it may also be a part of another character.

Based on this regulation, we offered search algorithm consider the structure of each different Chinese characters as well as its components. The characters are divided into three kinds of structures: Left-Right Structure, Bottom-Up Structure and Other structures. Based on the structure of the character and its component the user can find the unfamiliar character he wants to know. And the search result will include those characters which takes the result character as a component, so from a basic Chinese character the user can find a complicated one. Even if users are not sure about the structure of the character, we have search function that will return all characters have the input component, which may help those users.
When users check the characters, the tool will record his history and the number of references will be counted. In the homepage the website will show the most commonly searched characters and some basic information about them. And when searching Chinese characters, some basic components are already prepared for users and user can have more reference Chinese characters if needed. These functions are provided to help those who are not sure how to type Chinese and make the tool more convenient and easy to use.
5. Result Exhibition

5.1 Data Structure and Database

In section 4.3 I introduced the basic database structure, and in this section I will explain the data structure and how the data is used by the web based tool in detail.

5.1.1 Table hanzi

<table>
<thead>
<tr>
<th>#</th>
<th>Name</th>
<th>Type</th>
<th>Collation</th>
<th>Attributes</th>
<th>Null</th>
<th>Default</th>
<th>Extra</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>id</td>
<td>int(11)</td>
<td></td>
<td>No</td>
<td>None</td>
<td></td>
<td>AUTO_INCREMENT</td>
</tr>
<tr>
<td>2</td>
<td>cha</td>
<td>varchar(16)</td>
<td>utf8_unicode_ci</td>
<td>Yes</td>
<td>NULL</td>
<td></td>
<td>NULL</td>
</tr>
<tr>
<td>3</td>
<td>part1</td>
<td>varchar(16)</td>
<td>utf8_unicode_ci</td>
<td>Yes</td>
<td>NULL</td>
<td></td>
<td>NULL</td>
</tr>
<tr>
<td>4</td>
<td>part2</td>
<td>varchar(16)</td>
<td>utf8_unicode_ci</td>
<td>Yes</td>
<td>NULL</td>
<td></td>
<td>NULL</td>
</tr>
<tr>
<td>5</td>
<td>type</td>
<td>int(11)</td>
<td></td>
<td>Yes</td>
<td>NULL</td>
<td></td>
<td>NULL</td>
</tr>
<tr>
<td>6</td>
<td>structure</td>
<td>int(11)</td>
<td></td>
<td>Yes</td>
<td>NULL</td>
<td></td>
<td>NULL</td>
</tr>
<tr>
<td>7</td>
<td>numofref</td>
<td>int(11)</td>
<td></td>
<td>Yes</td>
<td>NULL</td>
<td></td>
<td>NULL</td>
</tr>
</tbody>
</table>

Table hanzi is used to store the information of Chinese Characters. And there are in total 4930 Chinese characters inside this table. Parameter id
is the id of character, set as a reference number. Cha is the character itself while part1 and part2 are components of the characters. Although a character actually can have more than two components, I tried to made the structure simplified. For example, a Chinese Character ‘霖’,
can be seen has a ‘雨’ and two ‘木’ as its component, but it can also be seen as a Bottom-Up structure character with component ‘雨‘ and ‘林’,
and ‘林’ is a Left-Right structure with two ‘木’ as component. So by searching ‘木’, users can find ‘林’ then find ‘霖’.

In order to make search function more convenient, I set different types for different characters based on its complexity. And for those basic characters with simple structure, and those often occurs as a component of other characters, will be shown on the search page for users as a reference.

And structure shows whether the character is Left-Right Structure, Bottom-Up structure or other structure. I used integer instead of varchar to reduce the size and simplified data structure.
Last but not least, the numofref contains how many times the character has been referred. This parameter can show the popularity of characters, and the popularity will affect the search result sequence.
5.1.2 Table hanzilinks

Table hanzilinks stores the hyperlinks to [www.zhongwen.com](http://www.zhongwen.com) of each character as referred before. Each cha has a link points to the relevant position in the data reference website.
The web based tool separates its users into three categories, first group are non-registered visitors, second group are registered users and third group are administrators. Registered users can add what he search before into collection for further review, and can give comments to each characters will do the searching. And administrators can manage the database and handle users’ comments. Unregistered visitor can register as a user by registration function the tool provided, but to be an administrator needs authorization.
Username is the username of the registered user and mima contains password. Job parameter is set to define whether the user with certain user id is a normal user or an administrator.

In the future, this data table will also contain email address of registered users and password security questions. These tables are added to help user find back their passwords, in case they may forget the password or username and cannot log into the website.
5.4 Table comments

<table>
<thead>
<tr>
<th>#</th>
<th>Name</th>
<th>Type</th>
<th>Collation</th>
<th>Attributes</th>
<th>Null</th>
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<td>id</td>
<td>int(11)</td>
<td></td>
<td>No</td>
<td>None</td>
<td>None</td>
<td>AUTO_INCREMENT</td>
</tr>
<tr>
<td>2</td>
<td>username</td>
<td>varchar(16)</td>
<td>utf8_unicode_ci</td>
<td>No</td>
<td>None</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>comments</td>
<td>text</td>
<td>utf8_unicode_ci</td>
<td>No</td>
<td>None</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>cha</td>
<td>varchar(16)</td>
<td>utf8_unicode_ci</td>
<td>No</td>
<td>None</td>
<td>None</td>
<td></td>
</tr>
</tbody>
</table>

Table comments stores users’ comments of each Chinese character. When searching characters, after finding the result user can share their opinion about the character and give their comments. Their comments will be recorded in this table. Username parameter shows who leaves the comments and cha shows which character the comment refers to. Last but not least, the comment parameter has contains what users comments for the character.
5.5 Table waitforconfirm

<table>
<thead>
<tr>
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<th>Name</th>
<th>Type</th>
<th>Collation</th>
<th>Attributes</th>
<th>Null</th>
<th>Default</th>
<th>Extra</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>id</td>
<td>int(11)</td>
<td></td>
<td>No</td>
<td>None</td>
<td></td>
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<td>cha</td>
<td>varchar(16)</td>
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<td>Yes</td>
<td>NULL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>part1</td>
<td>varchar(16)</td>
<td>utf8_unicode_ci</td>
<td>Yes</td>
<td>NULL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>part2</td>
<td>varchar(16)</td>
<td>utf8_unicode_ci</td>
<td>Yes</td>
<td>NULL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>type</td>
<td>int(11)</td>
<td></td>
<td>Yes</td>
<td>NULL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>structure</td>
<td>int(11)</td>
<td></td>
<td>Yes</td>
<td>NULL</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Since I am a one-man company, I do not have enough time input every Chinese character into the database, and when users search on the website, they may not be able to find the character they want to know. In order to help users, when they cannot find the character they want to know, they can alert administrator about the situation by submit an simple form, which include the character they want to find, its structure and its components. Actually only the character is a compulsory and if the user are not sure about other information they can leave these part empty.
5.6 Table collect

<table>
<thead>
<tr>
<th>#</th>
<th>Name</th>
<th>Type</th>
<th>Collation</th>
<th>Attributes</th>
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<th>Default</th>
<th>Extra</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>username</td>
<td>varchar(16)</td>
<td>utf8_unicode_ci</td>
<td>No</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>2</td>
<td>cha</td>
<td>varchar(16)</td>
<td>utf8_unicode_ci</td>
<td>No</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

After find the character users want to search on this web based tool, registered users can add the character into his collection, and by view his collection users can easily reviewed them. Only registered users can use this function and username as well as what character they collected will be recorded.
5.2 User Interface of the Web Based Tool

The UI design of this web based tool works for all three types of users, whether unregistered visitors, registered users or administrators. However, there are some difference for different types of users, and I will explain it in later
5.2.1 Header and Footer

Each page of this web based tool has a header and footer. They links to the most commonly used function, including but not limit to home page, search function, collection list which contains Character collected by each user, and sign in page. After login, the header will also show whether you are a registered user or an administrator, the hyper link to Sign in will also be changed to sign out.
5.2.2 Homepage

The home page shows the most commonly searched characters and its basic information, including its structure, the component of this character (some character may not be able to separate into two components), other characters which contain this character as a component, and a hyperlink which leads to detail information page of this characters.

Each character in green color is a hyperlink, if you click on it, it will lead users find more detailed information about the selected Chinese characters; and related Character only provide at most three most
commonly searched related characters. But the detailed information page will provide all related characters.

If the user is an administrator, there will be another part on the homepage which is management platform. Form here administrators can jump to management page to manage database. This section can only be accessed by administrators and will be exhibit later.
5.2.3 Registration, Sign in and Sign out

The web based tool offers a registration function which let visitors register as registered users. In this stage only username and password is needed. If the username is same as someone else’s, the system will alert you that the username already exists. The system needs the user type password twice in order to guarantee that the user didn’t make any mistakes while registration. If the registration is successful, the page will show this information and jump to Sign In page directly.
In the login page, user have to input username and password to sign in.

If the password does not match the user name, or the username does not exist inside the database, the system will alert user about the situation. And automatically jump back to the sign in page.
If the username match the password, the website will show sign in successful and then jump to the homepage automatically. At the time, the user is already successfully logged in and the login operation will be kept until the user log out.
As mentioned before, Chinese characters inside database are grouped based on its structure. So in the search function, user can search the unfamiliar character based on the structure of the character. If the character is Left-Right structure or Bottom-Up structure, he can type the component he knew into the corresponding search box and type search. Use the example referred before, if he wants to check the Character ‘霖’, he can type ‘木’ into the left-right structure search box and finds ‘林’. And by search ‘林’ in the bottom-up structure search box, he can find the character ‘霖’.
And if the unfamiliar character is neither left-right structure nor bottom-up structure, user can use the third search box, which will show all character contains the input component (including the input component itself).

After the search is done, this web based tool will provide the searching result based on the structure of characters and the input component. The image above is the result by searching ‘木’ in all structure search box.
If user cannot find the unfamiliar character he wants to search, he can click the hyperlink on the top left side to tell administrators about the situation.

In case some users do not know how to type the components, the tool provided some basic components and some characters which are often been searched. And by click the hyperlink at the bottom part, a new window will be generated which contains more components which may help users.
5.2.5 Character Information

The detail information of Characters includes the structure of this character, its components and characters using this character as a component. And with the data from www.zhongwen.com, by clicking on the hyperlink, a new window will be generated which will lead to detailed information of this character, explaining the meaning of it and how to use this character.

And the left side is the navigation bar, click the subtitle the right side will jump to the corresponding position. Last but not least, users can leave
comments under the character they searched, and can view other comments.

Comments:
This character does not have any comments yet, please speak your mind freely.

Add Comments:

Character:  
Username: visitor
5.2.6 Collection

By click on the Collect icon on the top right side, the web based tool will add the character into the users’ collection. This function is only available after login, and the system will alert user about the situation after click this buttom.
And after click the hyperlink on header and footer, users can enter the database. If the user have not sign in yet, the system will alert this situation and jump to the sign in page.
Similar as search and homepage, web based tool provides basic information about the characters. And by click Remove from Collection user can remove characters from collection database.
5.2.7 Help enlarge database

Since the size of database is limited due to the lack of time and labor, user may not be able to find the character he wants to know by this web based tool. Of course I will try my best to enlarge the size of dataset, this tool can also offers function like Wikipedia that users themselves can also help enlarging the database.

If user cannot find the character in the search result page, he can just click the hyperlink above to mention this situation. He can input the
basic information about characters, including the character itself, its structure and its components. Only the character part is compulsive.

After users submit the form, the system will store the information inside the database, wait for administrators come and manage them. Administrators’ operation procedure will be introduce later
5.2.8 Management Platform

Only administrators can enter management platforms, and in this page administrators can see the characters users claim they cannot find. By click on the hyperlink Finish management administrators can add the character into the database by manually and after input the data into database, administrators can click remove application to delete the data entry. Pending means the data is not handled and finished status shows that the character is already inside database.
6. Future Blueprint

6.1 Short term modifications

In the short run, this project can be improved by implementing some modifications. First is the data structure. Chinese characters inside database are written in text format, and some components cannot be displayed successfully. However, if the data are stored in image format, all characters and components can be displayed and the performance of the web based tools can be improved.

Another disadvantage of my project is the size of dataset. I will try my best to include more Chinese characters and with the help of users, the tool may work as Wikipedia and the size of dataset can be enlarged.

At this stage the user interface is clear, but not attractive enough. I am planning to improve the UI design to make it help attract and keep more users.
6.2 Long term arrangement

Since I want to make this web based tool easy to use, only offer the web platform version is not enough. It will be more convenience if I can make it as a mobile application, so people can use this app whenever they meet unfamiliar characters. And with the development of computer vision technology, scanning the unfamiliar character and match it with data inside database may also be a possible solution, if the data type of Chinese characters is set to be images. It takes time and labor to make these ideas come to reality, but when it really works this tool can be more convenient for users and easier to use.

I want to set this project as a non-commercial software which can help those people that want to search Chinese characters and learn the relationship between different characters. However, when the website really goes to the internet, it takes some labor and money to rent server and database as well as for daily maintenance. So in order to keep this tool functioning in the long run, I have to find a way to earn profits.
One way to achieve this goal is to corporate with education service. If the tool has proved useful and reliable, I can corporate with education system so that not only I can guarantee the tool from operating, but also the tool can have more potential users. Another way to earn profit for this tool is advertising. By adding advertisement into this tool, it may earn some cash for making this website, as well as the potential application, much better in the future.
7. Conclusion

Being an one-man company is really an unforgettable experience in me, and the knowledge, skill and experience FPY brought to me will definitely change my life.

As I student, the final year project is a great opportunity for me learning how a real world project is designed, constructed and implemented. What problems will a real world project faced and how to solve all these difficulties while some of them can be predicted but others come unexpectedly.

I faced some difficulties when doing the project. And by finding ways to solve these problems, I learned a lot, not only programming skills but also the knowledge on how to solve these difficulties. After finished this project and uploaded it onto the server, it gives me a feeling of success. This is the first time I finish a real world project on my own, and I do believe that I will never forget this experience.
I should appreciate a lot to my supervisor. He is so kind that offers me lots of kindly advice, and his suggestion is really useful for this project. I cannot finish this project with his help.

In conclusion, as an undergraduate student, the final year project is very important for my student life as well as my future career. I will keep what I learned in this project and try my best to perform better in the future.