272 - Enterprise Software Platforms

Project Title : A Flashcards based web application for Collective Learning in Organic Chemistry

By
Project Group - Team 6

Project Guide
Rakesh Ranjan

S.No	Name	SJSU ID	Email ID
1	Varun Teja Maguluri	016018964	varunteja.maguluri@sjsu.edu
2	Naga Lakshmi Nagubandi	016648710	nagalakshmi.nagubandi@sjsu.edu
3	Meera Tresa Sebastian	016592784	meeratresa.sebastian@sjsu.edu
4	Pratik Rajnikant Shah	016626779	pratikrajnikant.shah@sjsu.edu

Contents:

1.Introduction

The scientific course that people fear taking the most is organic chemistry. Compared to other science courses, it has the highest failure rate, the lowest class average, and the most retakes. However, organic chemistry is generally given the same weight in schools as conventional chemistry or physics. Many students feel organic chemistry is difficult to study. The main reason is that it requires a lot of memorizing with a bit of logic. The majority of students are not adept at remembering things. Students who are adept at memorizing things usually take anatomy or physics classes rather than inorganic chemistry. It's all about processes in organic chemistry, explaining how and why reactions happen, and maybe even deciphering a few puzzling graphs. Organic chemistry is extremely challenging because of THIS.

Studying and remembering large volumes of information is easier and more effective with flashcards. So, we are designing a website to create multiple user-defined technical flashcards. These will have questions on one side and corresponding responses on the other side of the flashcards. Each flash card will be saved and can be used by the user anytime to conduct a quiz for himself for memorization of the concepts stated above.

1.1 Purpose

Flash cards are little note cards that are used to practice knowledge retrieval in order to test and enhance memory. Flashcards are hands-down the most effective way for motivated learners to learn and retain factual knowledge. This project supports adding and viewing the cards, can take the quiz in order to test the memory, users can update the profile, and explore more flashcards.

1.2 Objective

The main objective of this project is to serve the purpose and develop flash cards based web application for collective learning in organic chemistry. We will accomplish the following tasks

- Clearly define all the system's functional and non-functional requirements.
- Design a client-server application consisting of a single page and REST API coupled to a SQLite database that meets the requirements.
- Test, deploy and host the system on a server.

- Perform beta tests with students to ensure the application's functionality, usability and scalability.

1.3 Motivation and Project description

What makes organic chemistry difficult for many students? The majority of Organic Chemistry is memorization with a bit of logic thrown in for good measure. The majority of students do not consider themselves excellent at memorizing and solving problems.

A person who is proficient at memorizing things usually concentrates on anatomy and physiology classes. A person who is capable of recalling an enormous amount of information in detail is an impressive individual.

A person who is proficient at solving problems tends to stay in the physics field. They are able to memorize first principles and then use their exceptional logic skills to fill in areas others might not have the time or ability to memorize. There is a possibility that they could remember things, but they don't feel like they should.

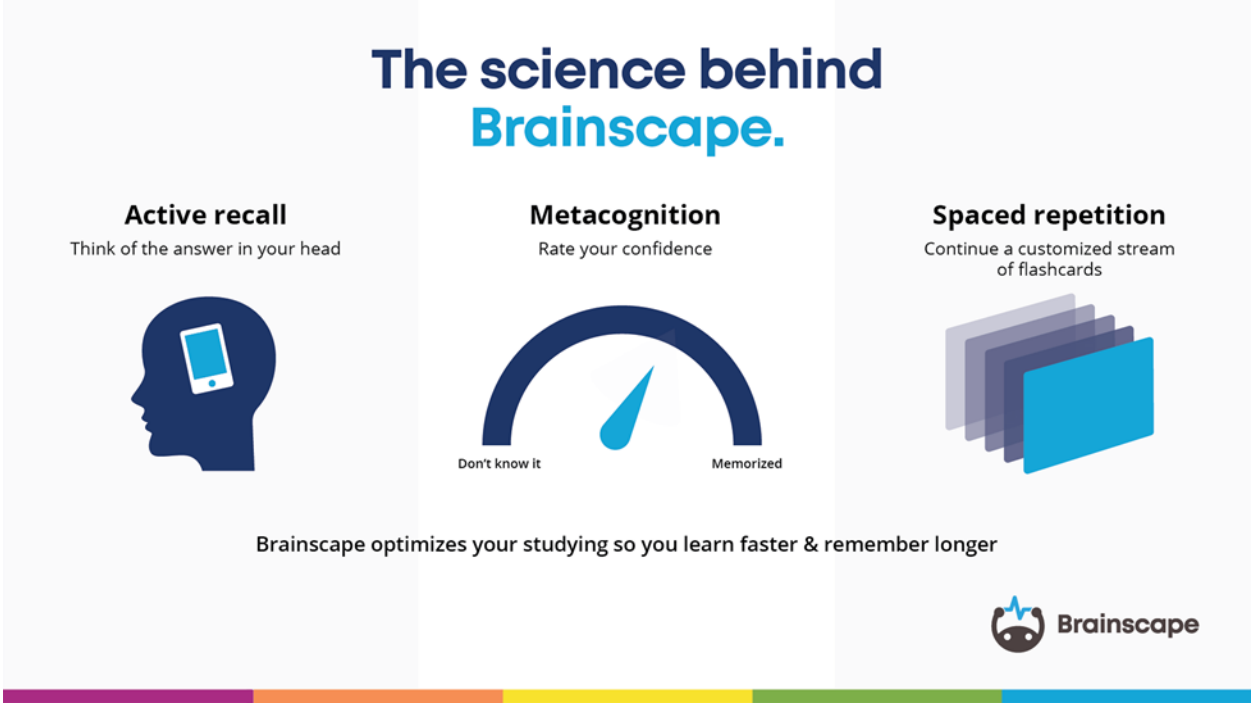
Organic chemistry sits at the intersection of these two ways of thinking. There are quite a few complex problems that require a great deal of memorizing and problem-solving skills. The result is that people are forced to step outside their comfort zones. People who are used to memorizing fail at applying the things they try to memorize. Organic chemistry, which does not follow first principles, is not suitable for those who are used to building things from the ground up. The rules for reactivity are highly flexible, and there are often as many exceptions to the rules as there are cases that fall within them.

So, we are designing a website to create multiple user-defined technical flashcards. These will have questions on one side and corresponding responses on the other side of the flashcards. Each flash card will be saved and can be used by the user anytime to conduct a quiz for himself for memorization of the concepts stated above.

Are flashcards effective?

Studying and remembering large volumes of information is easier and more effective with flashcards. While it may seem like flashcards are used primarily by kids, there is a reason they have remained a popular study method for hundreds of years: **They're effective!** When used properly, flashcards are hands-down the most effective way for motivated learners to learn and retain factual knowledge. It has valid scientific reasons.

The benefits of flashcards:



Flashcards engage active recall:

By looking at a flashcard's front "question" side and thinking of the answer, you are engaging in a cognitive process called active recall. Thus, rather than merely staring at your textbook or taking a multiple-choice quiz, you're actually trying to recollect the concept from scratch (and we all know that multiple-choice quizzes are terrible for studying).

Memory traces that are recalled actively create stronger connections between neurons. The greatest benefit of flashcards is that they can easily be repeated, which makes them an efficient way of creating many memory-enhancing recall events. Active recall retrieval practices can improve retention by 150% compared with passive studying, according to research.

Flashcards engage metacognition:

The moment you reveal the correct answer, you are essentially asking yourself in order to evaluate your correctness, “How did my answer compare to this correct answer?” and “How well did I know (or not know) it?” This act of self-reflection is known as metacognition. Brainscape

takes this further by asking you to assess *how well you remember the answer* to a question on a scale of 1 (not at all) to 5 (like the back of my hand!)

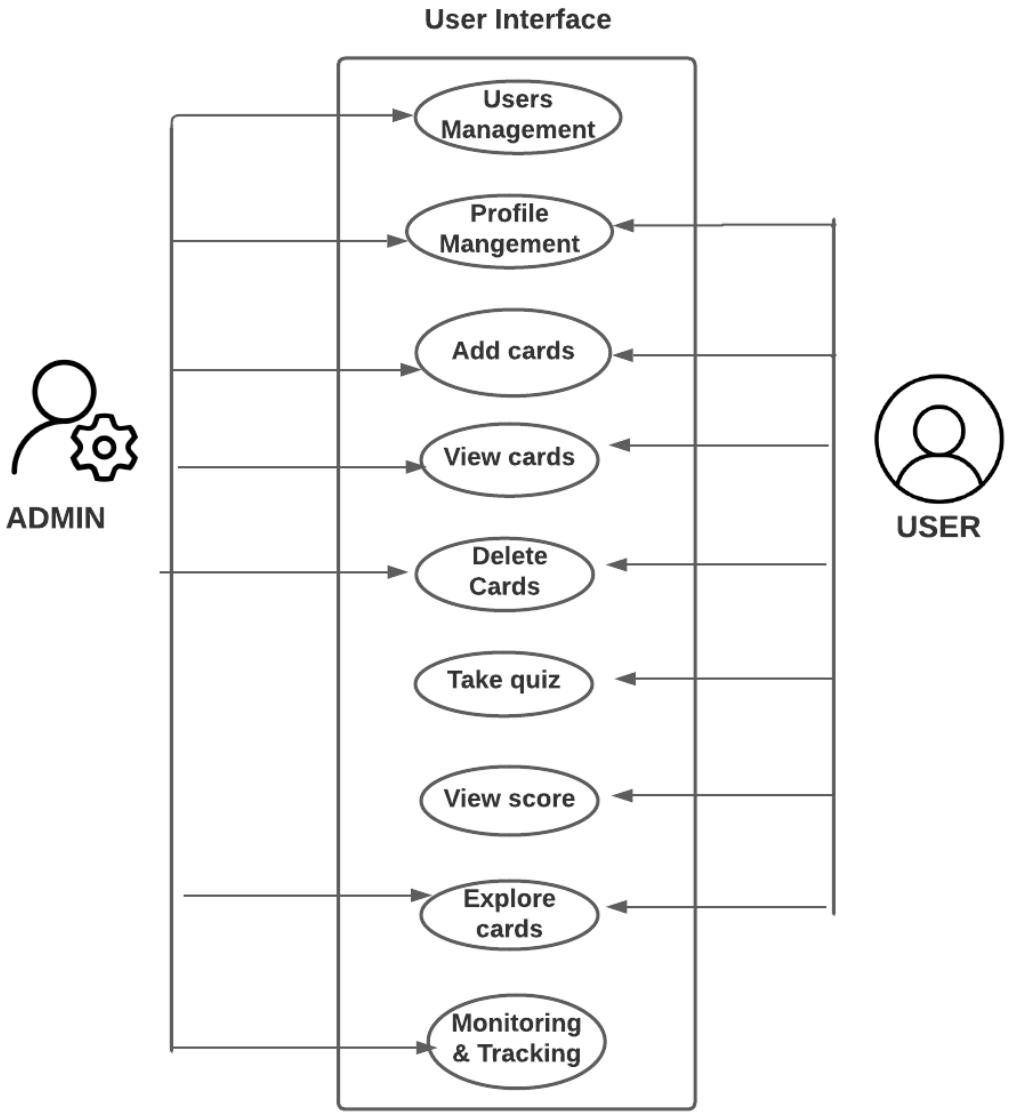
Flashcards allow for confidence-based repetition:

In contrast to books or documents, since flashcards aren't tied to any book or document, you can sort them into piles depending on whether (or how often) you need to review them. After that, you can revise concepts you are confident in occasionally, while studying those you aren't confident in more often.

Researchers have proven that this type of repetition (derived from spaced repetition) improves memory performance in the most scientifically tested way possible.

2. System Requirements and analysis

2.1 User Perspective Design



2.1.1 User Group Specifications

User	Responsibilities
Client	● Profile management ● Add flashcards ● Delete flashcards ● View flash cards ● Explore more flash cards ● Take quiz

2.1.2 Service Group Specifications

Service	Functions	User Group
Manage Profile	● Login, Logout ● Update profile ● Create User	Client
Flashcards Management	● Add flash card ● View flash card ● Delete flash card	Client
Testing	Take the quiz to test the knowledge	Client
Exploring	Can explore more cards in order to learn organic chemistry	Client

2.2 User Scenario Analysis

2.2.1 Client Users

These users are the students who want to learn organic chemistry. These users first signup for our application and then login into our application. Once they logged in, they can see 5 modules in our application - add cards, my cards, take a quiz, profile and explore more modules. Users can add, view, delete flash cards, can explore more flash cards, can take a quiz to check what they have learnt so far. Users can also update their profile.

2.2.2 Administrator/system service staff

These users support back-end servers like database in our case. These users manage client users and keep track of the application.

2.3 System Services

For Client

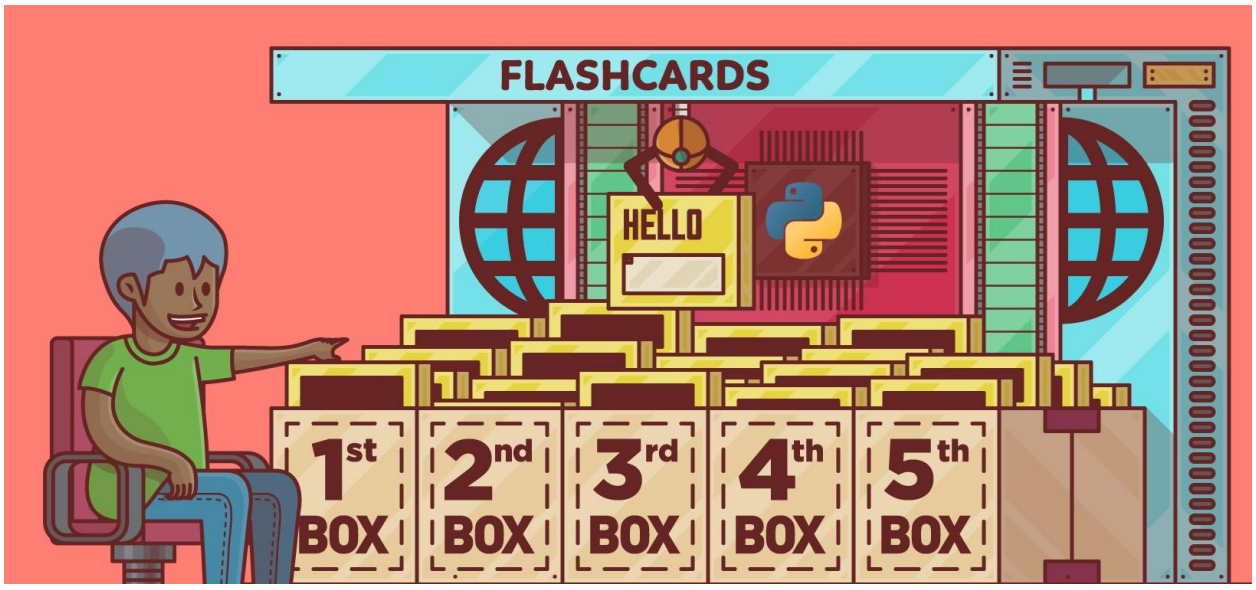
- Keep track of known and unknown flash cards
- Add/view/delete flash cards
- Can check his understanding of organic chemistry by taking a quiz
- can learn more about flash cards by exploring the Explore page.

For Admin

- Add, Update, Delete users/clients
- Monitor and track the web application

3. System Infrastructure and Architecture

The following are the components in our project

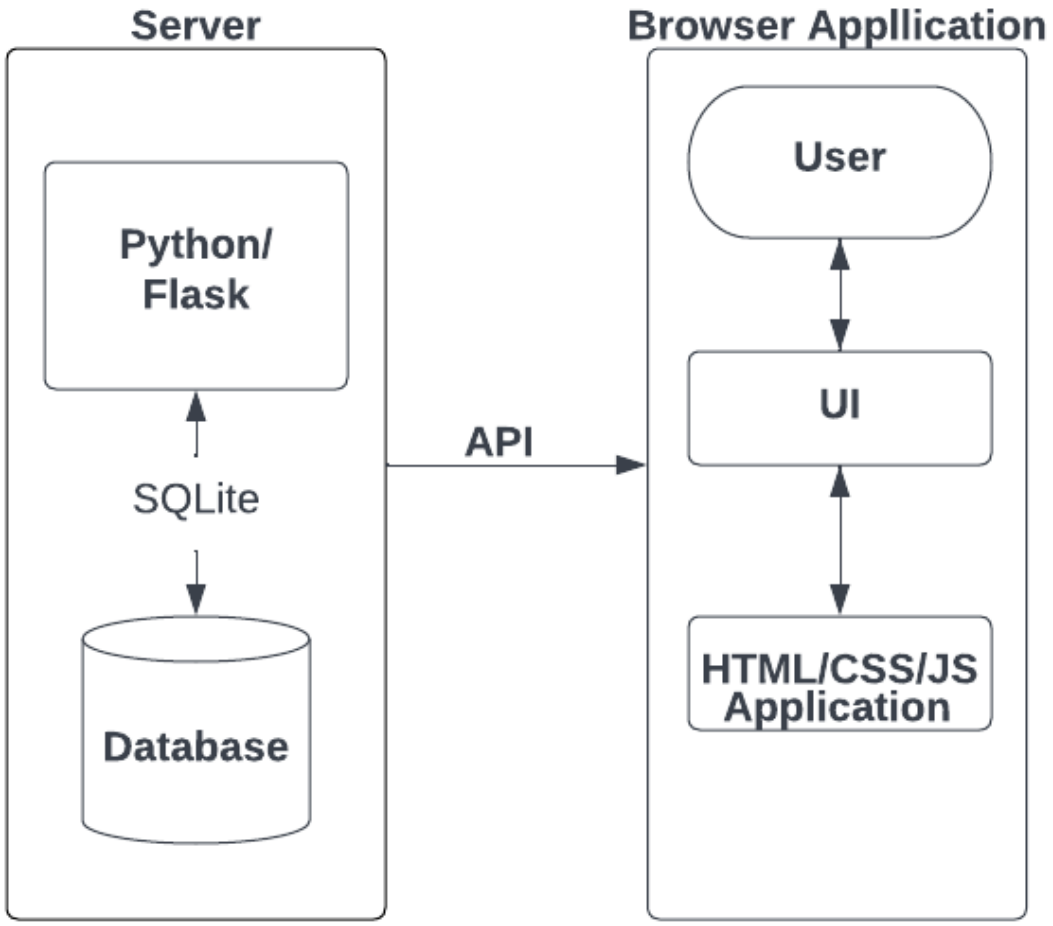


3.1 Client - Server Model:

Client-server architecture is used for the design of the application. Presenting a presentation layer, also known as the front end, and a data access layer, also known as the back end.

Separation of concerns is a key principle of client-server architecture. There is a separation between the user interface concern and the data storage concern. As a result of the server component's simplification, the user interface is more portable across other platforms and the system's scalability is increased. This enables the parts to be developed separately.

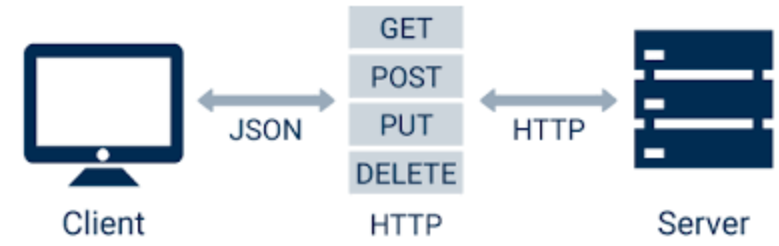
Following is a summary of the technologies used to implement our project

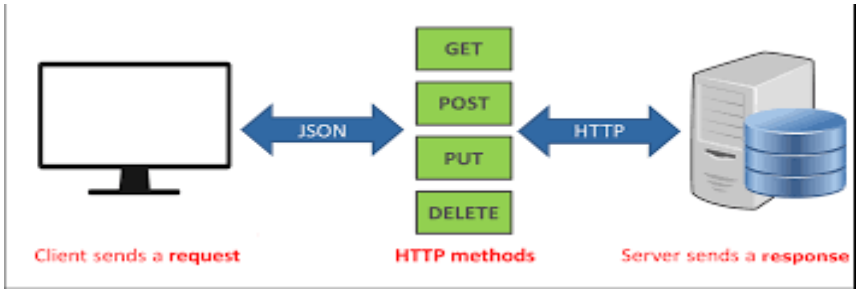


3.2 REST API:

We have used the REST API to transfer data between client-side and server-side. REST API stands for Representational state transfer application programming interface. A collection of endpoints, or routes, that can be used to get or modify data on the server were specified by the REST API. REST API employs five different sorts of requests.

- GET: Used to fetch data
- POST: Used to send data
- PUT: Used to replace existing data
- PATCH: Used to modify existing data
- DELETE: Used to delete existing data





3.3 Relational Database:

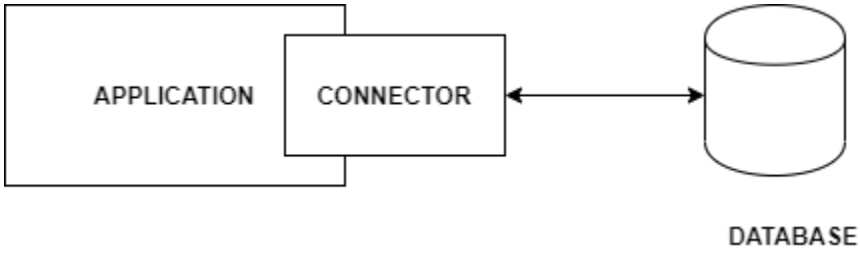
A relational database is used to store the data on the server. In relational databases data is stored in the form of tables. There will be a unique key for each table in a relational database. We can link one table to another table using a foreign key. Foreign key is nothing but a unique key of another table. Structured query language is used to manipulate and get the data from the tables in relational databases.

3.4 Python SQLite:

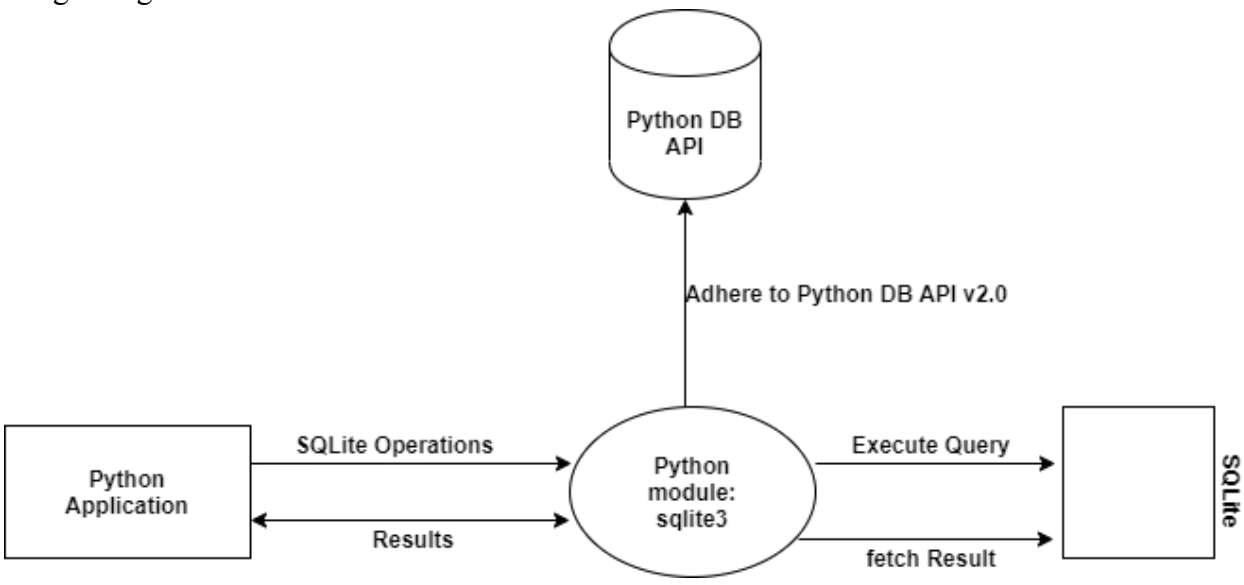
Databases provide a wide range of functions that enable easy management of massive amounts of data over the web as well as high-volume data input and output using regular files like text files. The query language SQL is widely used in databases. MySQL is a widely used database. A "light" version of SQL that uses syntax very similar to SQL is called SQLite. A self-contained, highly reliable, embedded, fully functional, public-domain SQL database engine is SQLite. On the internet, it is the database engine that is most frequently utilized. Since version 2.5 of the Python software, a library for working with SQLite databases named sqlite3 has been part of the Python package. These are some of the features of SQLite.

- Serverless
- Self-Contained
- Zero-Configuration
- Transactional
- Single-Database

Serverless
A server is not necessary for SQLite to function. The program that accesses the SQLite database is linked to it. Applications communicate with SQLite databases by reading and writing directly from the database files that are kept on disk.

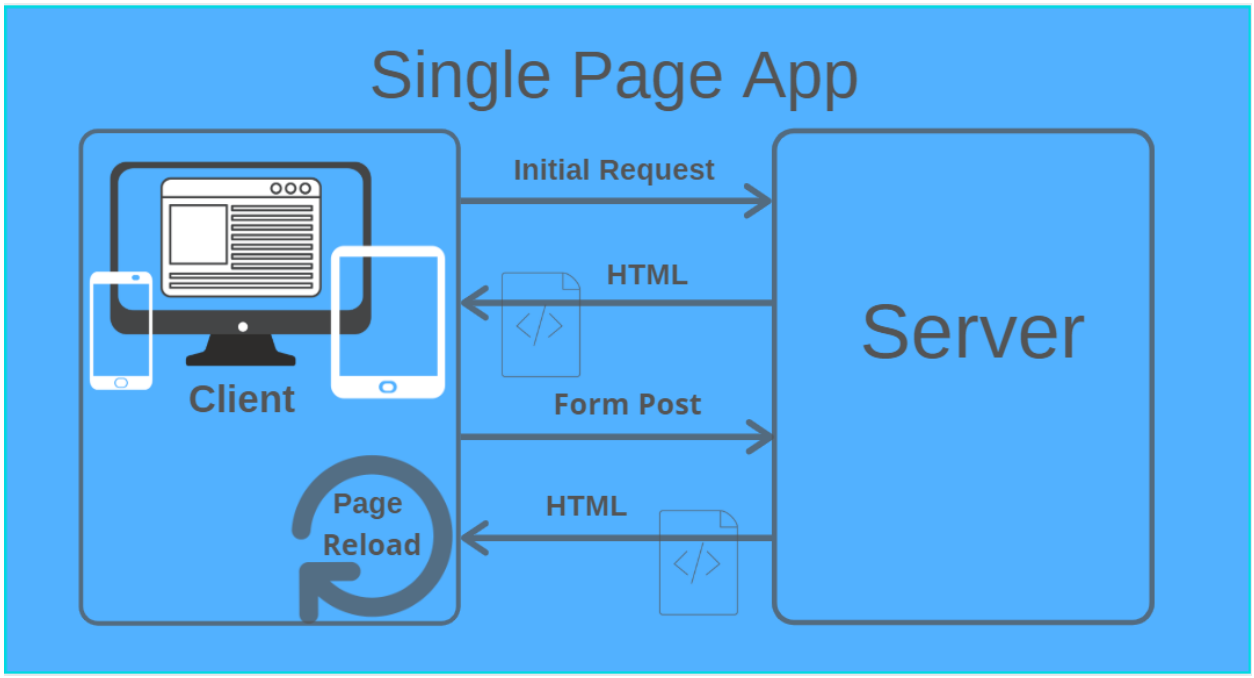


Self-Contained
Because SQLite is self-contained, it does not require any external dependencies, such as an external operating system or library.
Zero Configuration
Since SQLite requires zero configuration, there is no setup or management required.
Single-Database
As a single database, SQLite enables simultaneous access to numerous database files using a single database connection.



3.5 Single Page Application:

The client application is created using HTML, CSS, JavaScript as a single page application (SPA) to enhance user experience while also delivering a high level of speed and performance on the web page. A web application or website known as a "SPA" dynamically reloads certain page elements in response to user interactions rather than downloading new pages from the server, which lowers the amount of data that needs to be fetched and speeds up the program.



3.6 Python with Flask:

The server was created using the Python programming language. Python was chosen due to its focus on readability, simplicity, and the wide range of libraries and packages available. The fastest-growing major programming language, according to Python, which is steadily gaining in popularity. The advantages mentioned above make it possible to develop a server application that is readable and maintainable.

There are numerous web frameworks available to handle the Python REST API implementation. Flask and Django are by far the two most popular frameworks, according to the 2020 JetBrains Python Developer Survey. While Flask is a micro web framework that attempts to keep its core basic but adaptable, Django is a more comprehensive, monolithic web framework with a high learning curve. When it comes to database administration and security, Django makes a lot of decisions for you; in contrast, Flask allows a large variety of third-party extensions, leaving the decisions up to the developer. Flask was selected as a web framework because of its simplicity and adaptability.

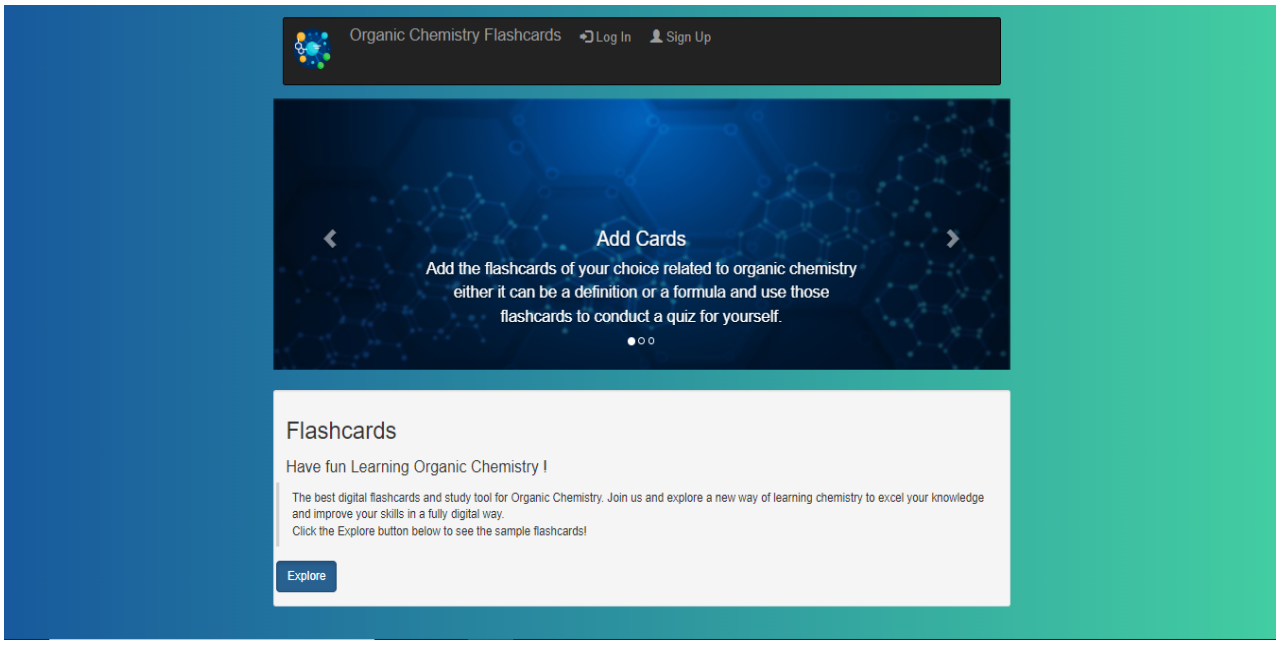
3.7 Deployed on Amazon EC2

Scalable computing power is offered by Amazon Elastic Compute Cloud (Amazon EC2) in the Amazon Web Services (AWS) Cloud. By using Amazon EC2, you can develop and deploy apps more quickly because you won't need to make an upfront hardware investment. Launch as many or as few virtual servers as you require, set up networking and security settings, and control storage using Amazon EC2. You can scale up or down with Amazon EC2 to manage variations in demand or popularity spikes, which eliminates the need to predict traffic.

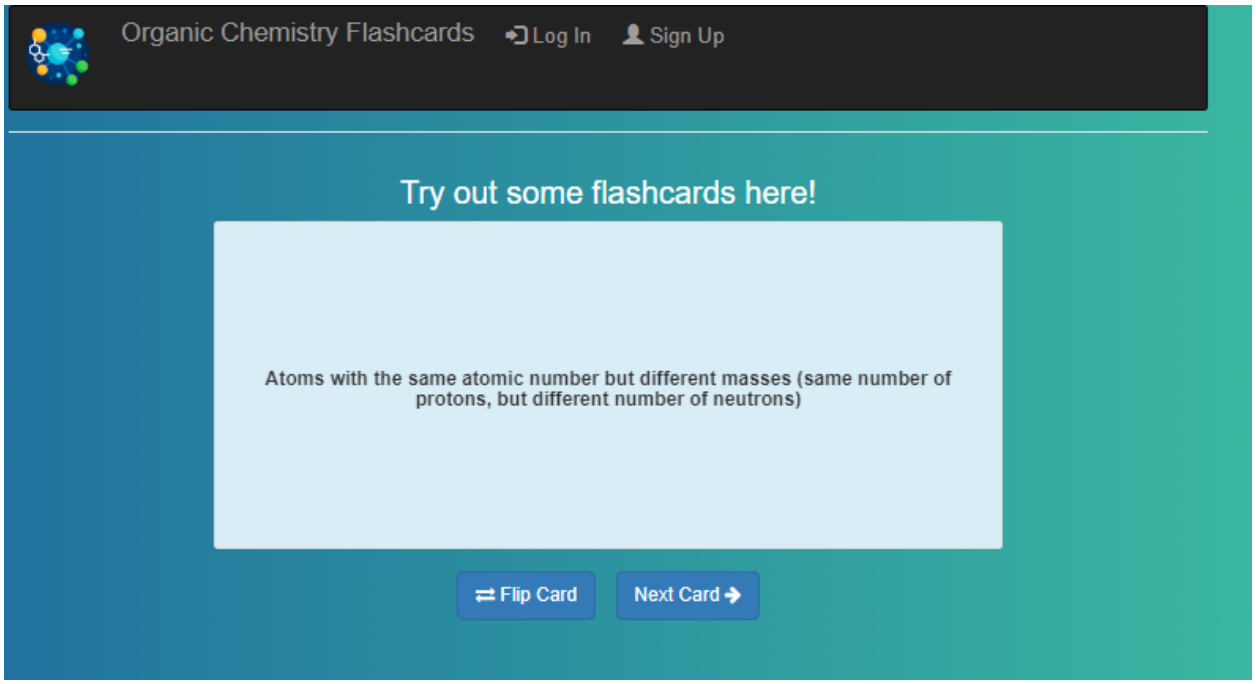
For developers, it is intended to make web-scale cloud computing simpler. The straightforward web service interface for Amazon EC2 makes it easy for you to get and set up capacity. You have total control over your computing resources and can use the tested computing environment of Amazon.

4. System Components

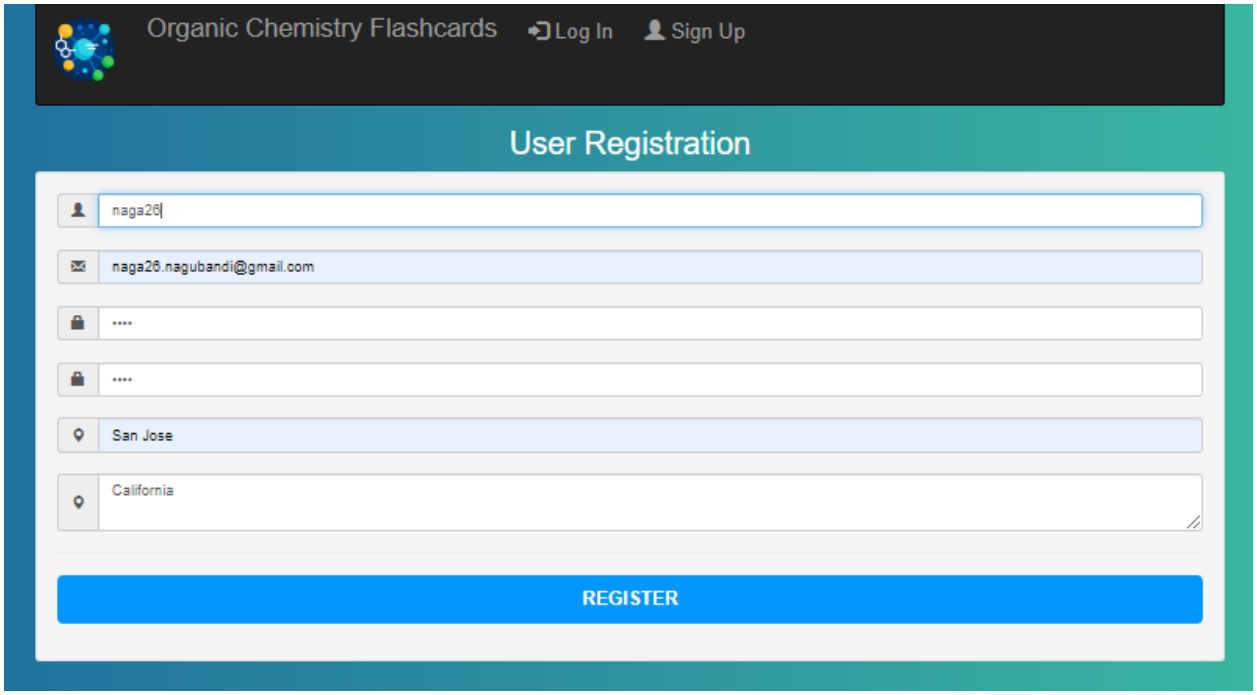
4.1 Component 1 - Home Page

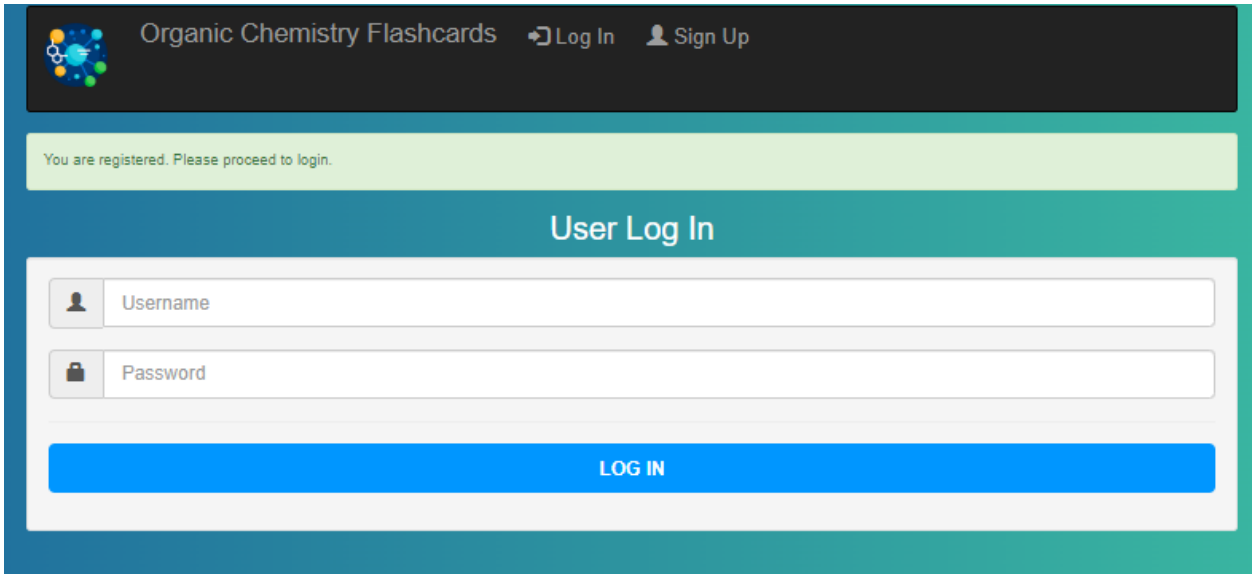


The above diagram is the home page of our application. First users have to sign up for our application and then login to our application. Before signing up for our application, users can see some sample flash cards by clicking the explore button on the home page.

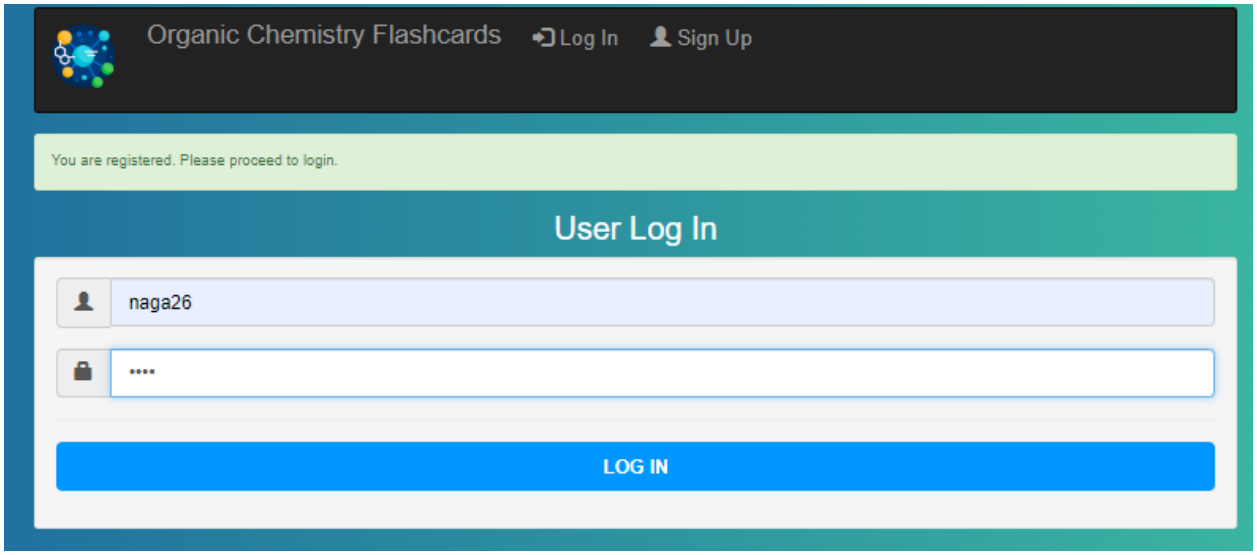

Organic Chemistry Flashcards
Log In
Sign Up
Try out some flashcards here!
Atoms with the same atomic number but different masses (same number of protons, but different number of neutrons)
Flip Card
Next Card

Signup Page:

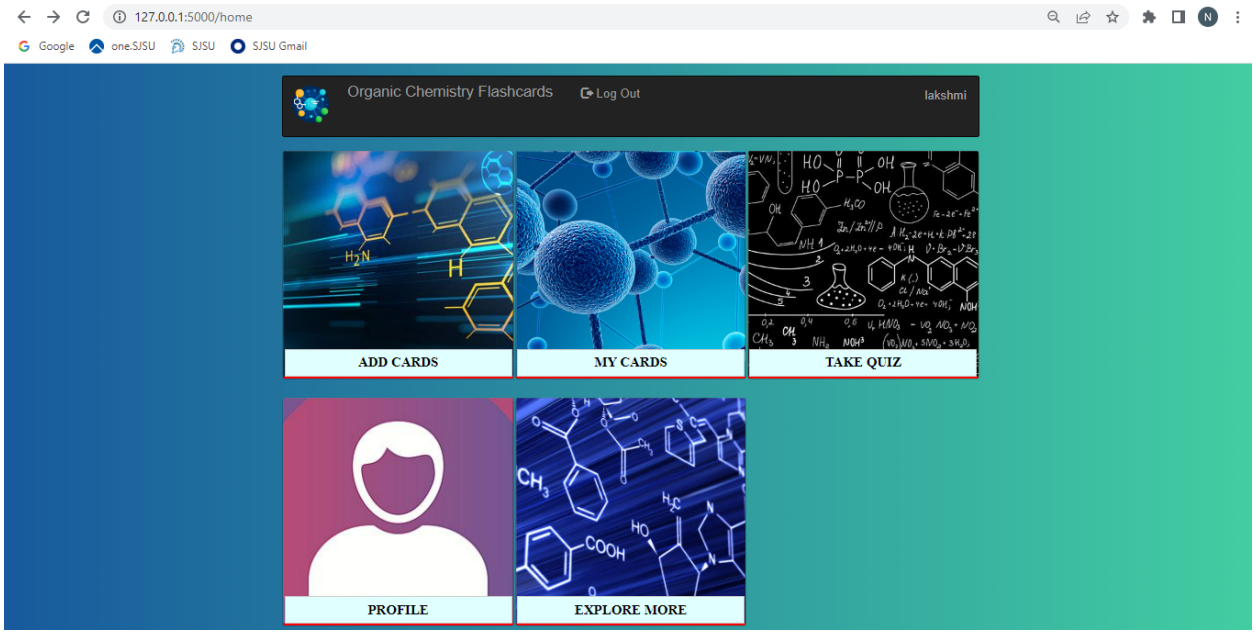

Organic Chemistry Flashcards
Log In
Sign Up
User Registration
naga26
naga26.nagubandi@gmail.com
San Jose
California
REGISTER



Login Page:



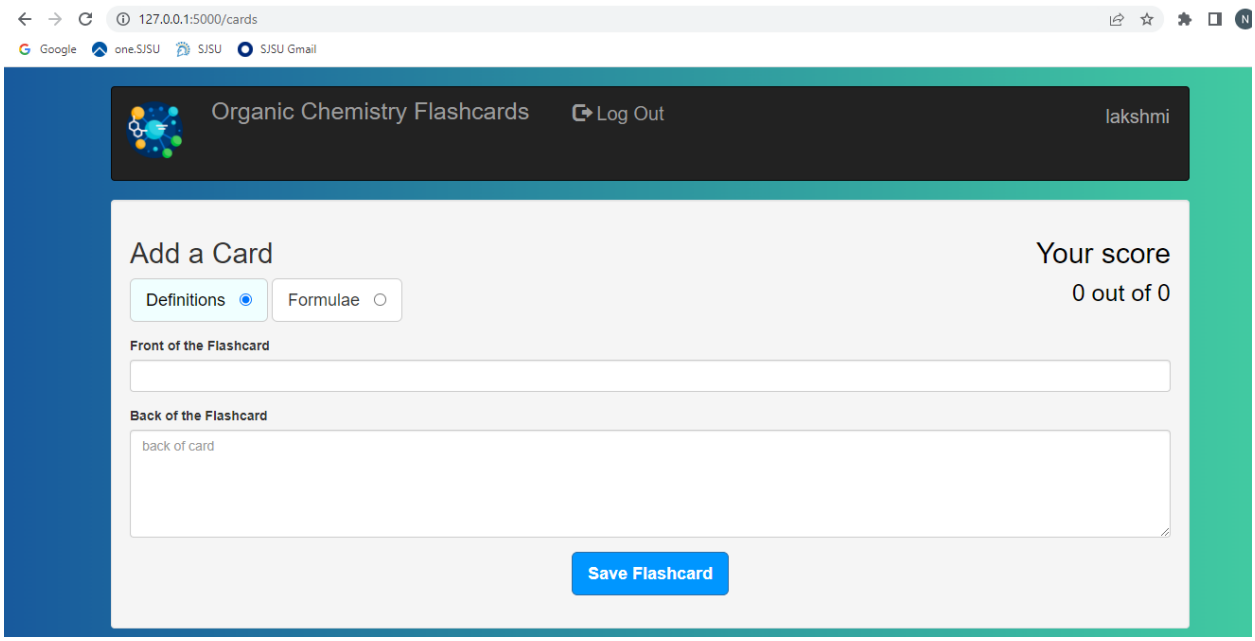
Once the user logins to our application, the user can add his own cards. After adding the user can see the cards on the MY CARDS page. Users can take a quiz to test their knowledge. Users can explore more cards on the EXPLORE MORE cards page. Users can update their profile on the PROFILE page.



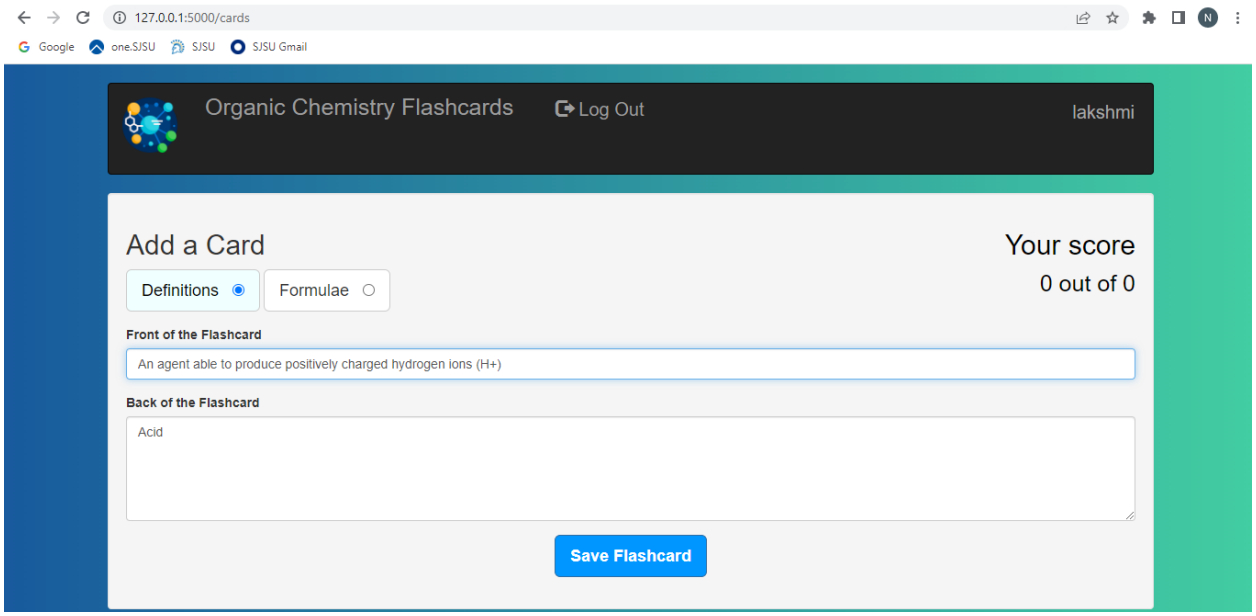
4.2 Component 2- ADD CARDS

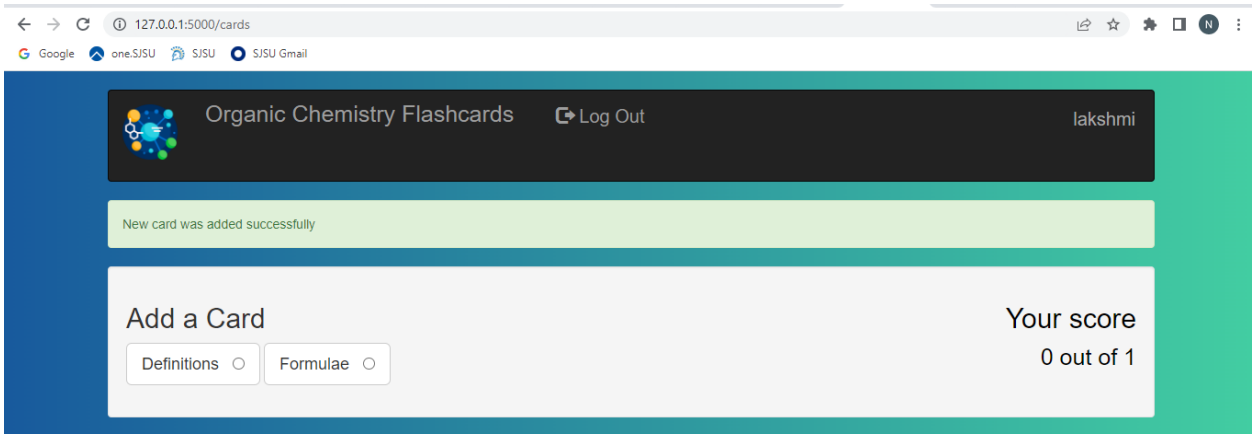
In this component the user can add a card. A card will have the front and back of the flash card. Front of the flash card displays the question whereas the back of the flash card explains/describes/reveals the answer.

- Can add a definition
- Can add a formula



Adding a definition flash card

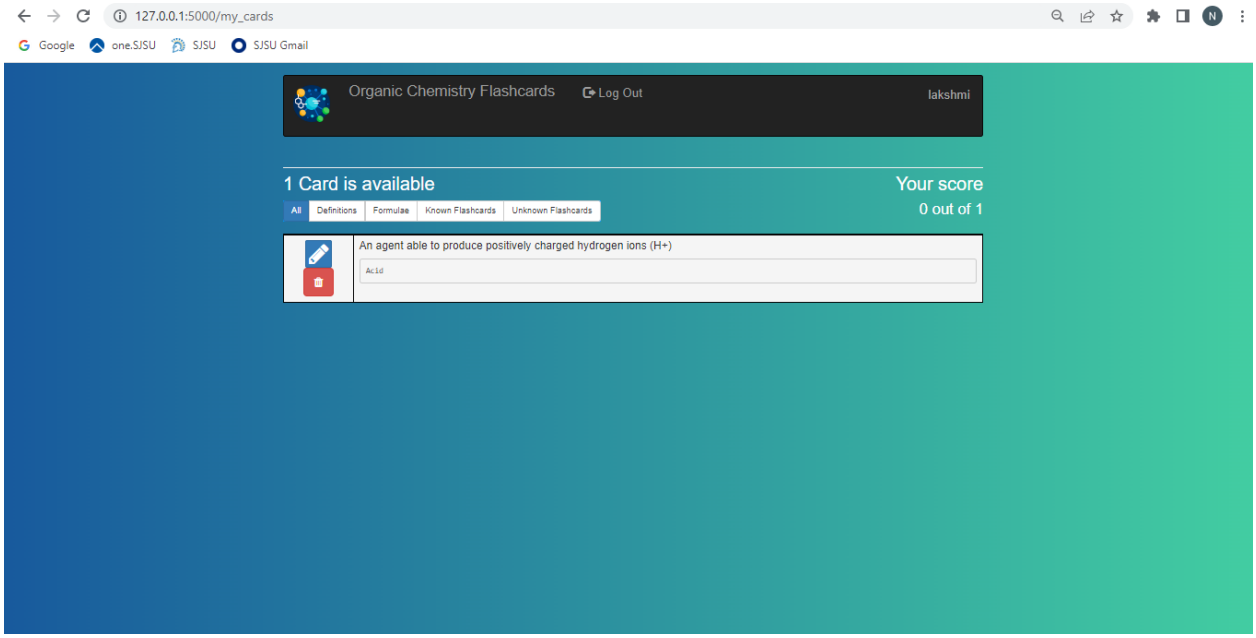


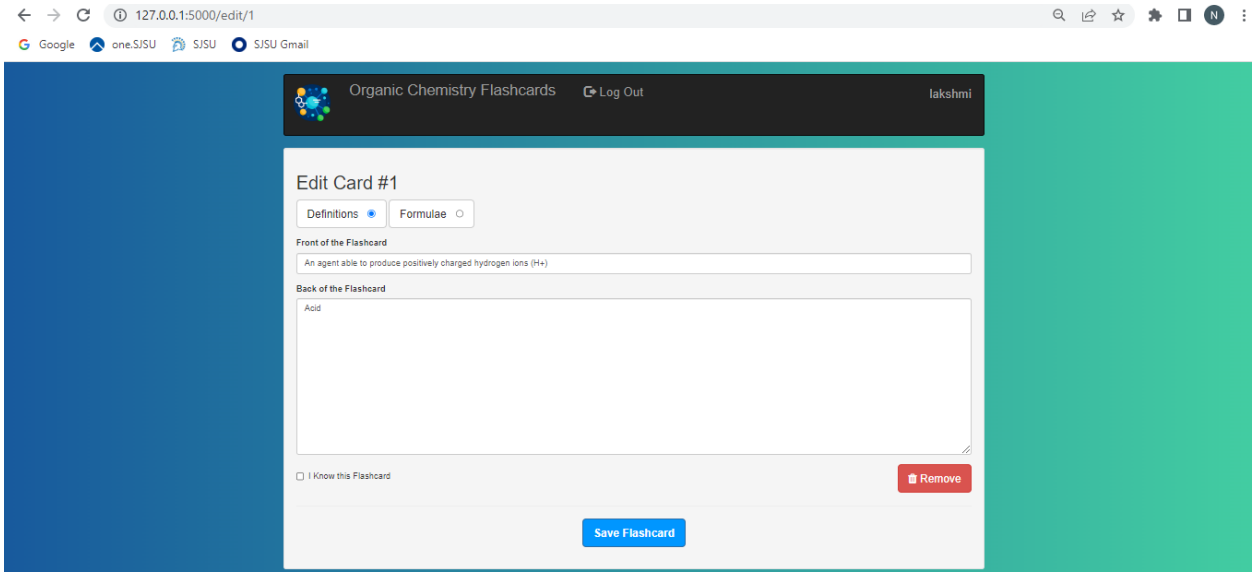


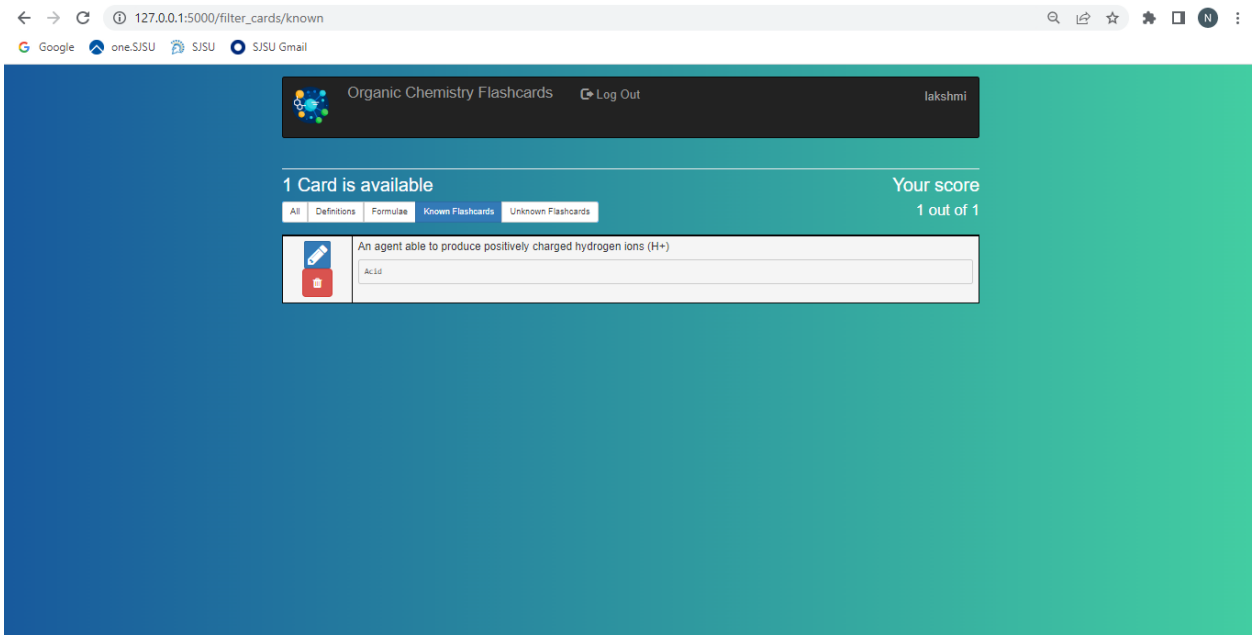
4.3 Component 3 - MY CARDS

Once the user adds cards in the ADD CARDS component, the user can see those cards in MY CARDS page.

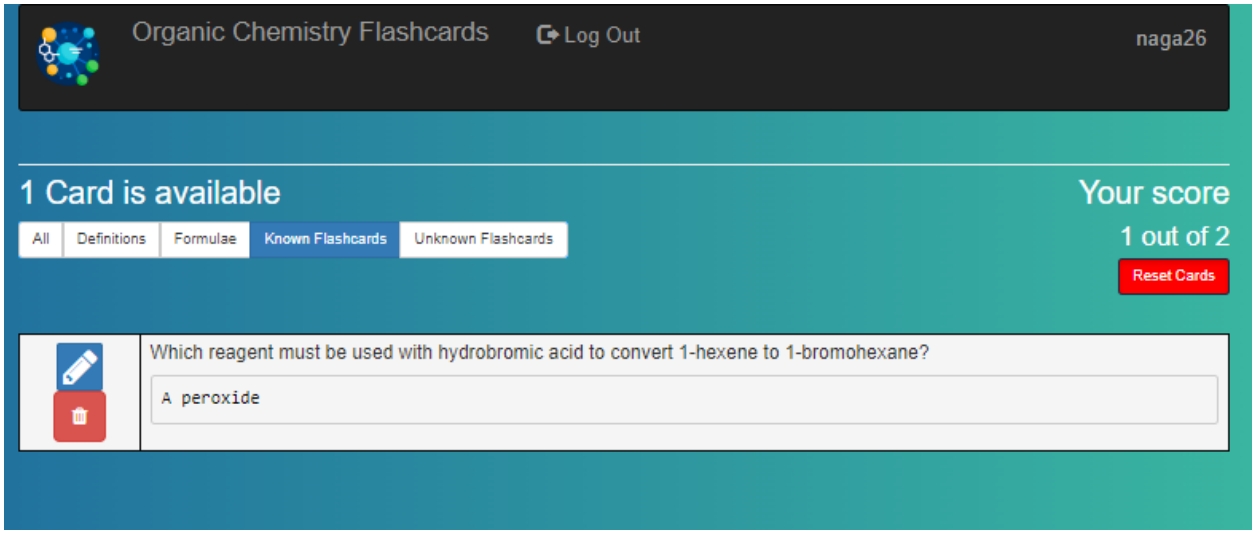
- Users can see all the cards in this page
- Users can filter the cards by definition and formula cards.
- Users can edit the cards
- Users can delete the card
- Users can mark the cards as known and unknown flash cards
- Users can reset the cards i.e, they can change unknown cards as known cards and known cards as unknown cards

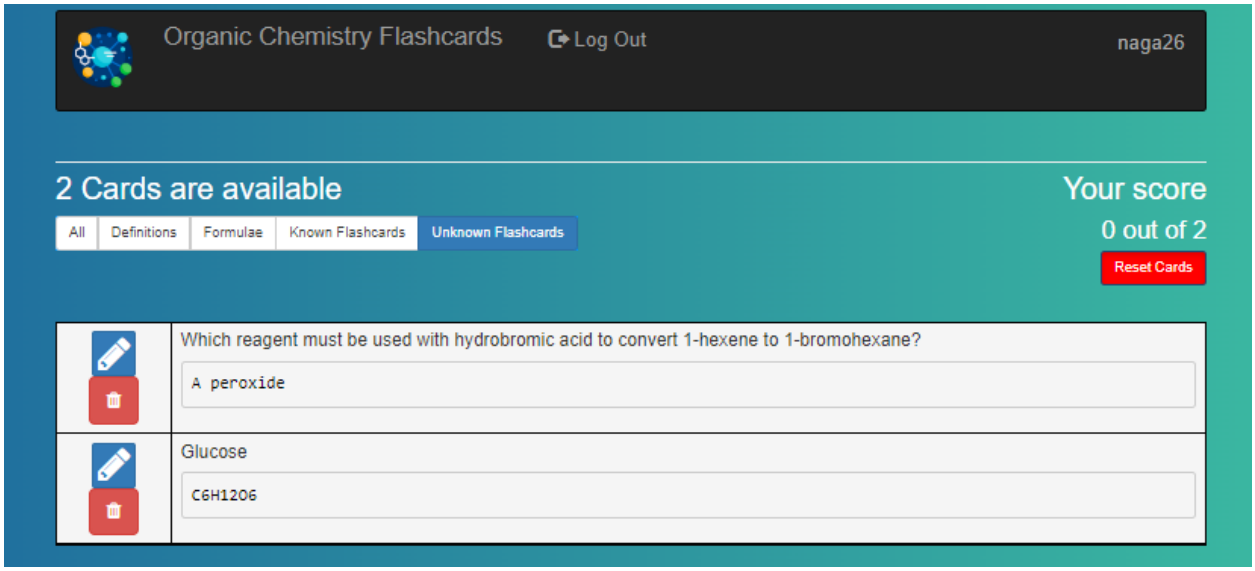






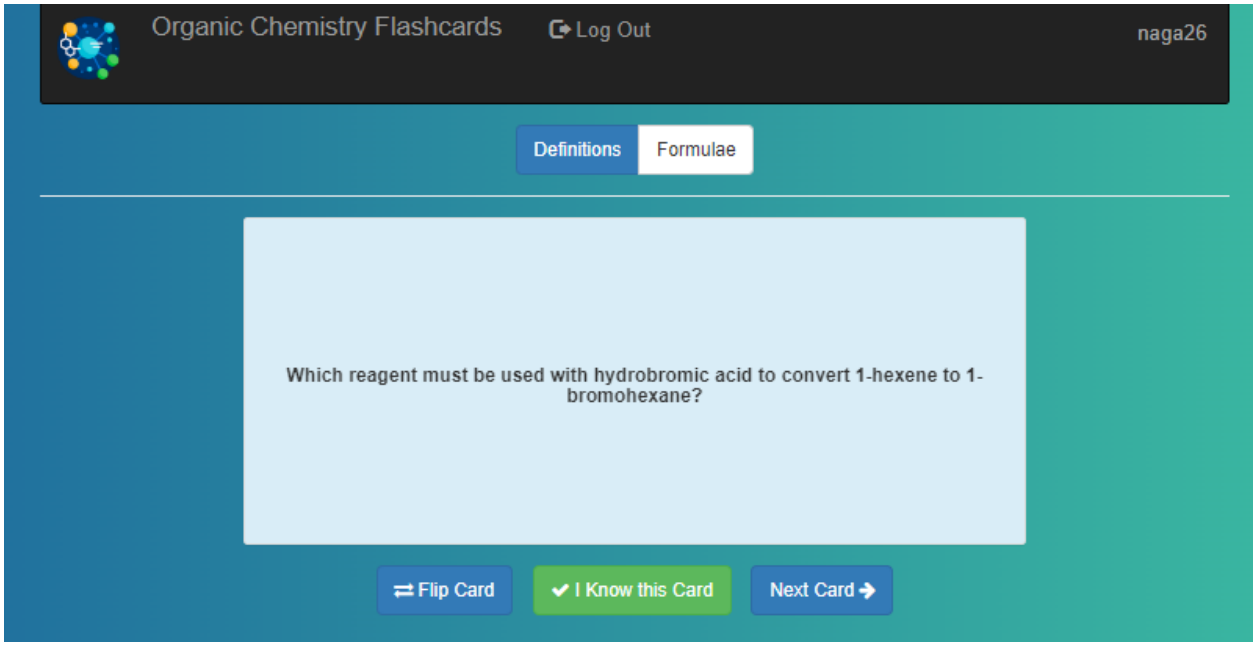
Resetting the cards:

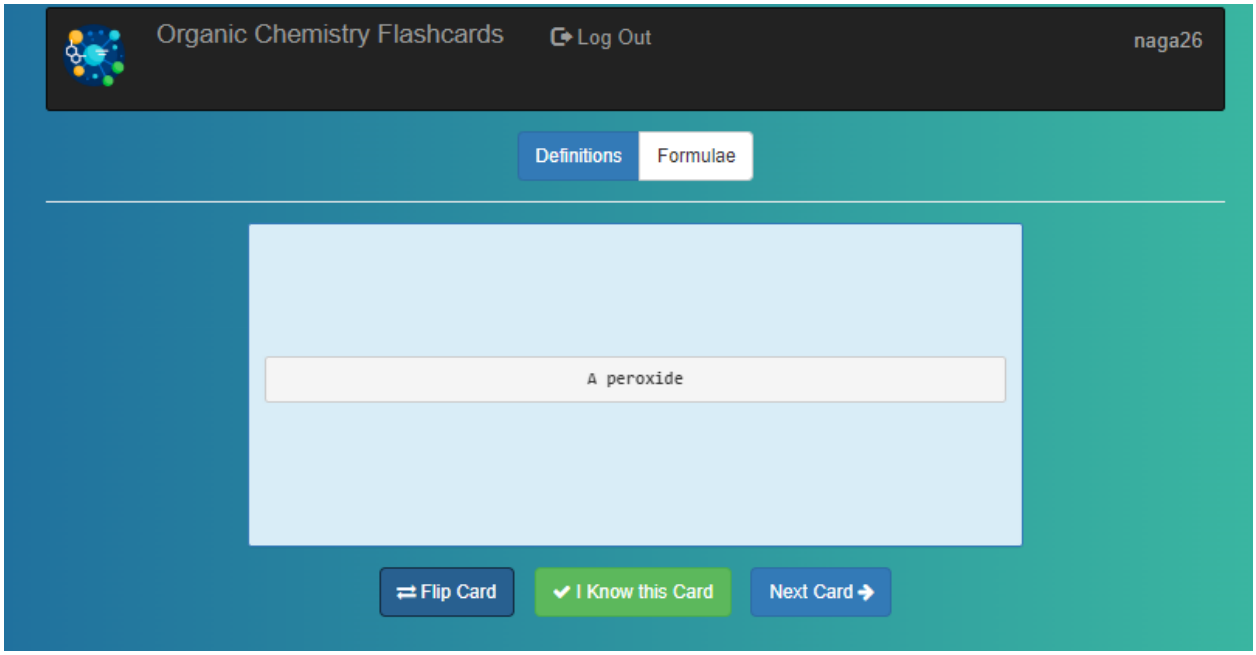




4.4 Component - 4- TAKE QUIZ

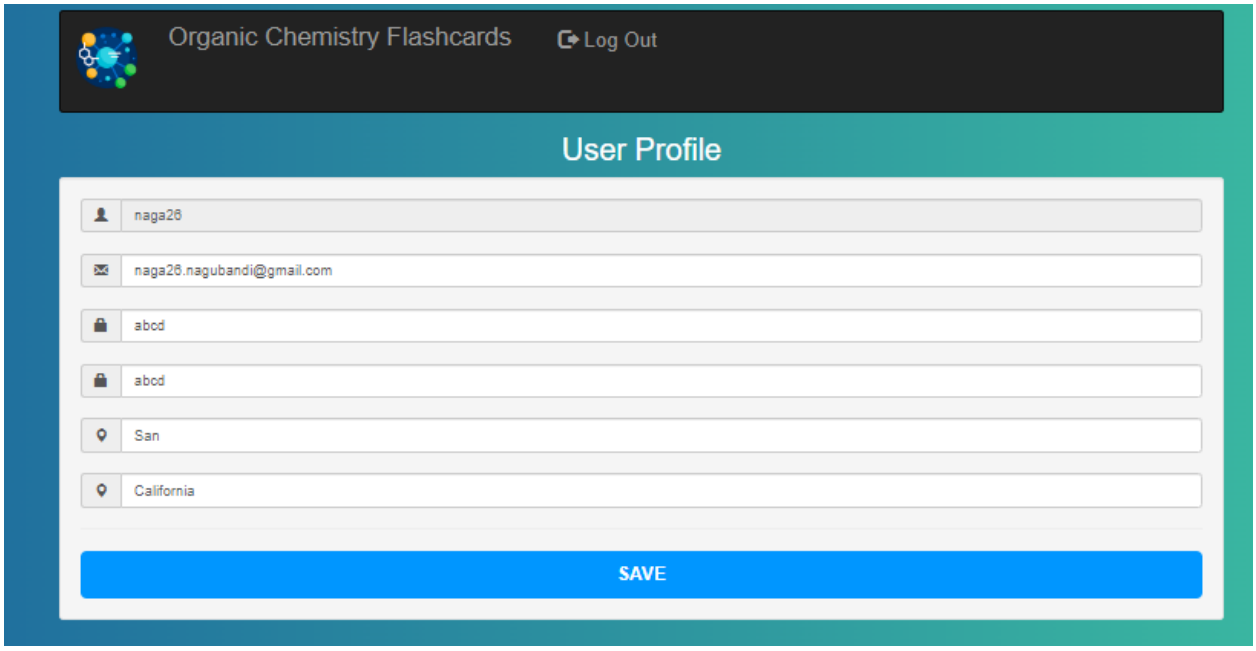
Once the user has read all the flash cards, the user can test their knowledge by taking a quiz. If the user knows the answer to the flash card, the flash card can be marked as known. If the user doesn't know the answer to the flashcards, the user can flip the flash card to see the answer. A user can skip the present flash card and go to the next one.

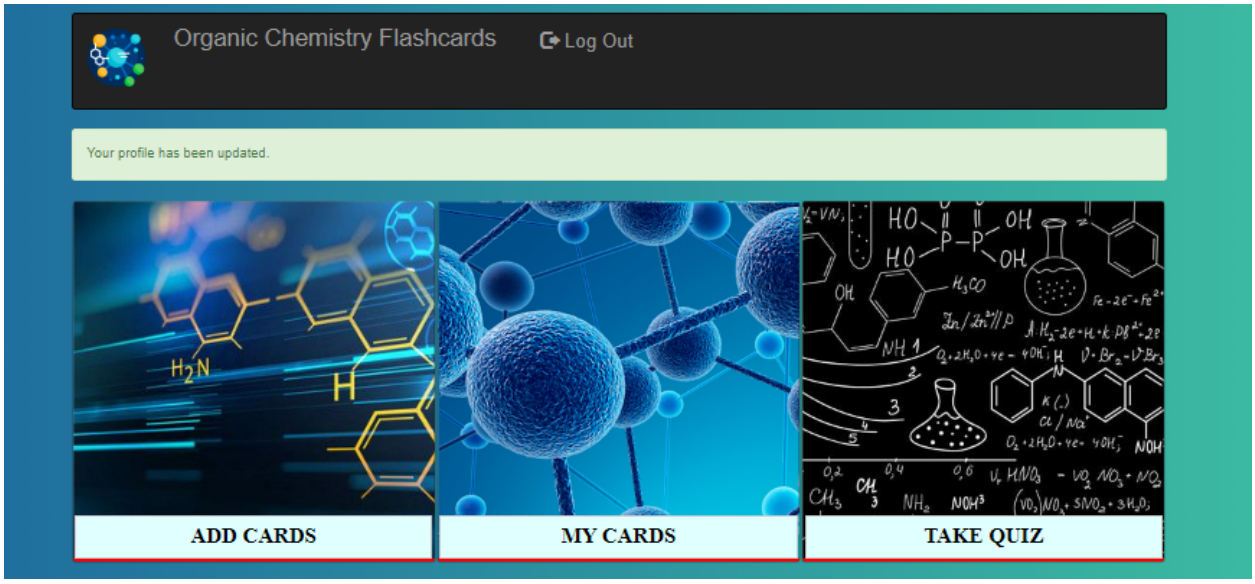




4.5 Component 5 - PROFILE

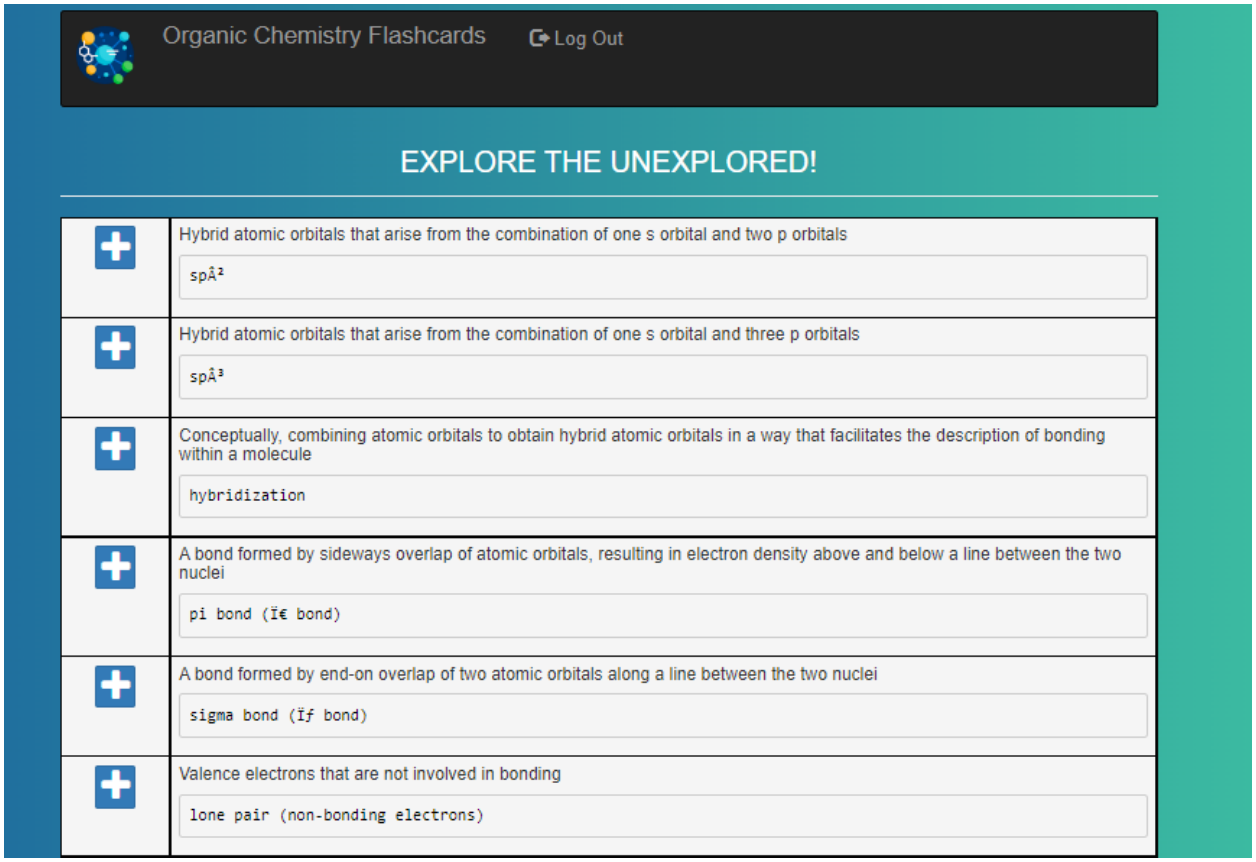
Users can update their profile except for their username. They can update their email, password, city, and state.

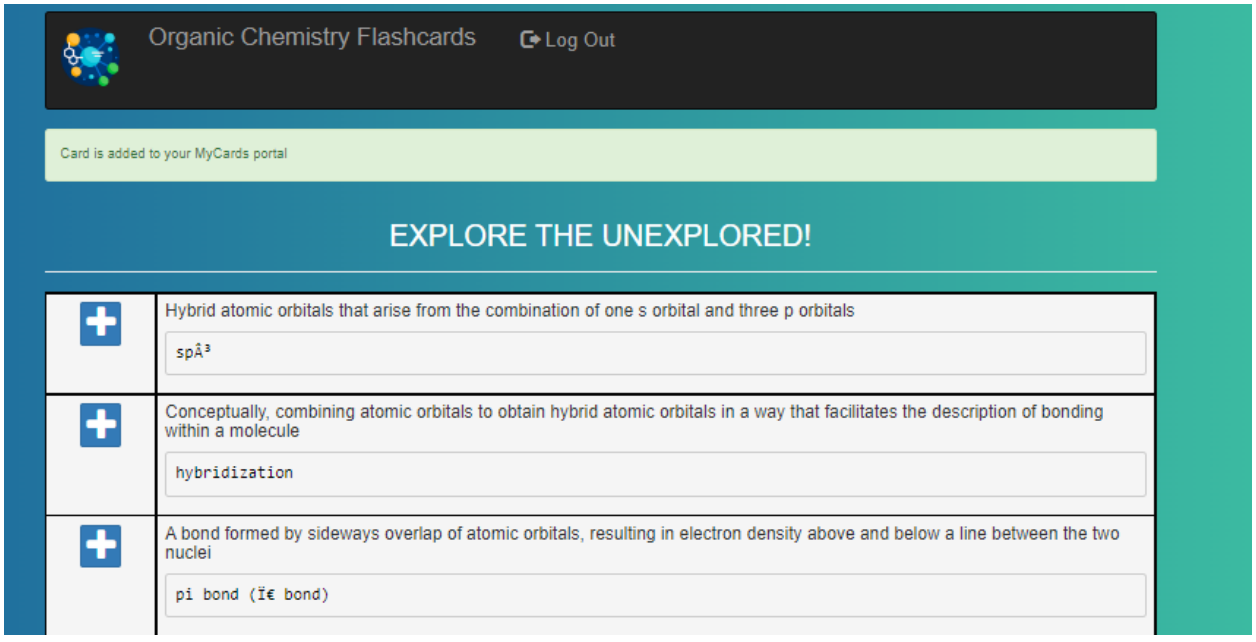




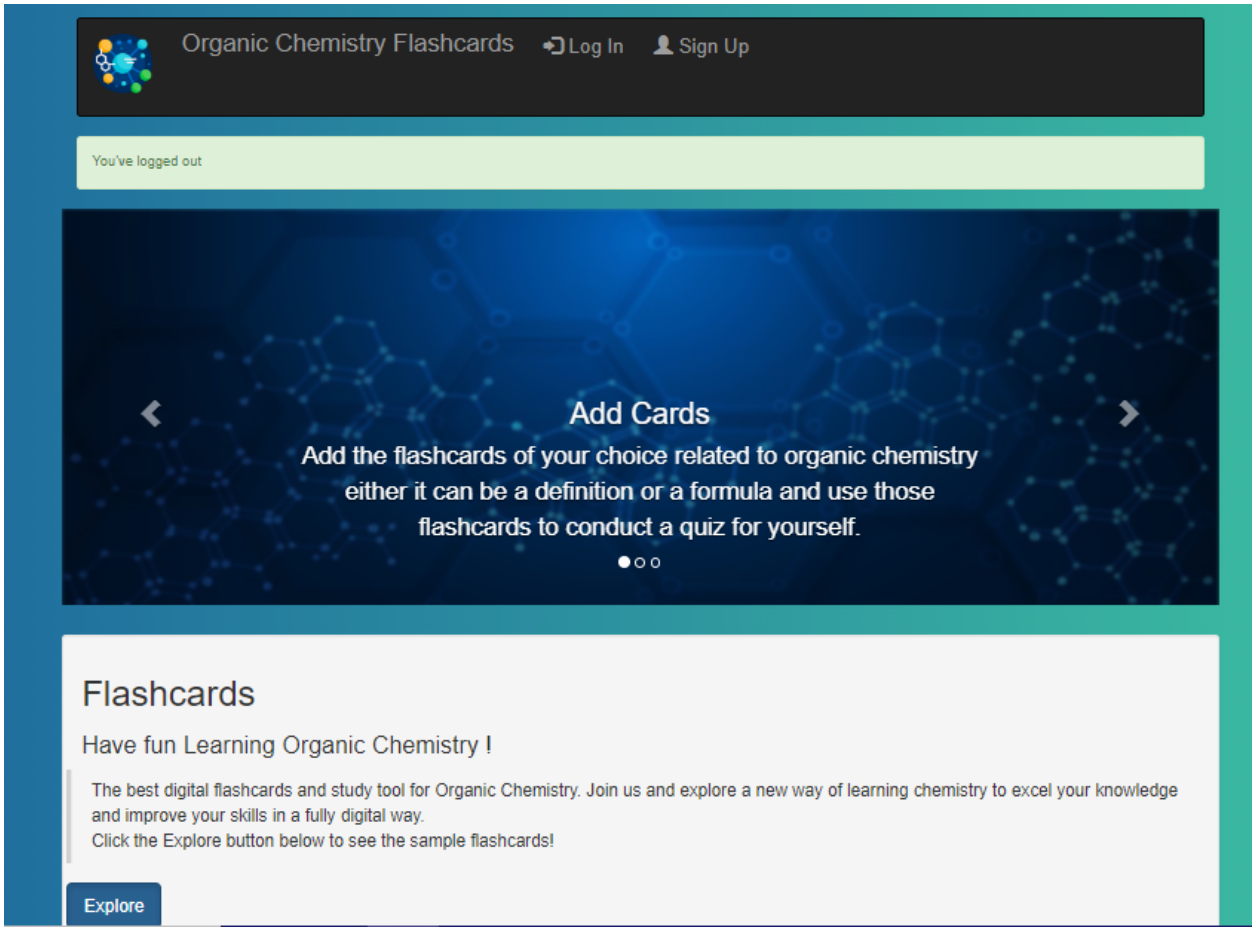
4.6 Component 6 - EXPLORE MORE

On this page users can explore more flash cards. They can add these cards to their My Cards page.


Organic Chemistry Flashcards
Log Out
EXPLORE THE UNEXPLORED!
Hybrid atomic orbitals that arise from the combination of one s orbital and two p orbitals
spÂ²
Hybrid atomic orbitals that arise from the combination of one s orbital and three p orbitals
spÂ³
Conceptually, combining atomic orbitals to obtain hybrid atomic orbitals in a way that facilitates the description of bonding within a molecule
hybridization
A bond formed by sideways overlap of atomic orbitals, resulting in electron density above and below a line between the two nuclei
pi bond (Ï€ bond)
A bond formed by end-on overlap of two atomic orbitals along a line between the two nuclei
sigma bond (Ïƒ bond)
Valence electrons that are not involved in bonding
lone pair (non-bonding electrons)


Organic Chemistry Flashcards
Log Out
Card is added to your MyCards portal
EXPLORE THE UNEXPLORED!
Hybrid atomic orbitals that arise from the combination of one s orbital and three p orbitals
spÂ³
Conceptually, combining atomic orbitals to obtain hybrid atomic orbitals in a way that facilitates the description of bonding within a molecule
hybridization
A bond formed by sideways overlap of atomic orbitals, resulting in electron density above and below a line between the two nuclei
pi bond (Ï€ bond)

.


Organic Chemistry Flashcards
Log In
Sign Up
You've logged out
Add Cards
Add the flashcards of your choice related to organic chemistry either it can be a definition or a formula and use those flashcards to conduct a quiz for yourself.
Flashcards
Have fun Learning Organic Chemistry !
The best digital flashcards and study tool for Organic Chemistry. Join us and explore a new way of learning chemistry to excel your knowledge and improve your skills in a fully digital way.
Click the Explore button below to see the sample flashcards!
Explore

5. References

[1]https://www.geeksforgeeks.org/python-program-to-build-flashcard-using-class-in-python/

[2] https://realpython.com/django-flashcards-app/

Github Link

https://github.com/VarunTejaMaguluri0090/Organic-Chemistry-Flashcards