SE-VAULT: A one-stop resource for all Software Engineers

– made with passion by developers for next-gen developers

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ABSTRACT

COVID-19 has wreaked havoc on most of the world's industries, of which, the effect on the software industry was found to be profound. It also impacted the mental health of employees which resulted in poor productivity. It showed companies the importance of establishing a *digital presence* and having better tools for *knowledge management*. However, the major constraint is the rapidly evolving technologies. As a result, many organizations had to frequently revamp their development and training programs. Through our SE-VAULT application, we give special focus to helping software engineers in learning to transition to trending technologies easy, smooth and enjoyable. Furthermore, our application aims on improving the *mental well-being* of the developers which is just as important as technical skills. It also helps increase interactions between the new developers and their mentors by streamlining virtual knowledge transfer sessions. The front-end was created using HTML5, CSS3, and JavaScript while the back-end is built using the FLASK web framework in Python. Our application comes with two types of user roles namely *Admin* and *User*. Admin has the authority to moderate content and manage all the users on the website. On the other hand, Users can create their accounts and access the website to view and upload relevant content. Some key features of the web service include Video Streaming across many genres, Recreational Sessions for mental well-being, Links to relevant resources/blogs, etc. Hence, it serves as a "one-stop resource" for all software engineers helping them in both their personal and professional development.

KEYWORDS

Software Development during COVID-19, Productivity, Mental Well-being, Digital Collaboration, Training & Development, Structural Design Pattern.

1 INTRODUCTION

During these difficult times of the COVID-19 pandemic, the software industry had to undergo tremendous changes in terms of the usual working environment [1]. Companies had to quickly adapt to the 'new normal' working conditions i.e., working and collaborating from home. Additionally, workplaces offer Training and Development programs which are essential to new graduates as well as existing employees who are looking to expand their skill sets. This program also plays an important role for the onboarding employees who recently joined the company. Due to this digital-shift, the career development program, which was mostly offered in-person, is being shifted to virtual platforms. Furthermore, apart from just technical training, there is a growing need for organizations to provide moral and mental support to its employees in the ongoing pandemic period.

We tried to analyze the changes that took place in the software industry during the COVID-19 pandemic. One study [2] shows that companies failed to adapt to these new-normal conditions. Furthermore, as per this study, mental well-being of the employees was not handled well. As a result, it was found that the stress level increased among the employees. Another key takeaway from the paper was that mentoring activity has significantly decreased. These findings highlight the important underlying issues which need to be resolved as they can affect the overall development process in the long run [3].

SE-VAULT is our joint effort aimed towards solving these issues. It is a web application which sets a strong, all-round foundational stage for beginners and enables them to excel in the industry training programs and fulfill their expected job requirements. Some of the key features of this web application include:

1) Video Streaming across different categories.
2) Recreational sessions.
3) Links to useful literature.
4) Focus on mental well-being.

SE-VAULT will follow Model-View-Template architecture. It will use Python-Django for back-end along with MySQL database. The front-end of the application will be designed using HTML5, CSS3 and JavaScript. The detailed illustration is explained through the architecture diagram.

2 RELATED WORK

2.1 Training and Professional Development Programs

Training and development programs play a crucial role in the career growth of an employee. One popular study [4] on this states that an effective training program should always strive to enhance employee performance which can in turn help an organization hold a good place in the market. Another article [5] proclaims that there is a need for companies to re-engineer their training and professional development programs. Here, the author suggests an idea to integrate self-paced and on-demand digital learning. We adopt this idea of learning in our implementation.

2.2 Mental well-being of Employees

unmind.com is a mental well-being platform for employees. It has a massive library on popular and unique subjects like fitness, lifestyle, and events. We incorporate this idea of using different recreational activities across varied genres in our webapp.

2.3 Knowledge Transfer Sessions

A study on mentoring programs for knowledge transfer has been conducted in a small-scale software company [6]. This study suggests that effective monitoring always contributes to a positive attitude towards work and career. Another study [7] proposes the implementation of an interactive web-based platform to improve the interaction between senior employees and beginners in the software industry. Future work of this research recommends combining interactive approaches with video-based learning which will add depth to the current material and also help employees learn at their own pace. Hence, we decided to explore the idea of combining these two approaches to help software engineers have a better overall understanding of SE processes and workflows.

3 BACKGROUND

3.1 MVT Architecture

There are numerous architectures which are very popular for web design applications and are used ver widely. MVT is one of them. MVT stands for Model-View-Template. This architecture is particularly popular because of the modular structure it provides. The application can be completely broken down into three different entities and thus can be helpful for distributive work and collaboration. Model consists of all the database(s) and the necessary CRUD operations to manipulate data. View is the back-end of the system where core business logic is implemented. Templates are nothing but HTML files that the end-users see on the front-end. Another important feature of MVT architecture is that it has low coupling and high modularity which is crucial in the designing phase of the application.

3.2 Selenium WebDriver

Selenium WebDriver is an open source web framework for performing cross-browser testing. This is used to test web-based applications to ensure that they work as expected. Selenium provides drivers for each browser : where the browser driver communicates with the relevant browser by creating a secure connection, without revealing the core logic of browser capabilities. This framework basically accepts commands and sends them to the browser. These browser drivers are also particular to the test case automation language, such as C#, Python, or Java. The main advantage of Selenium webdriver is that it is fast and compatible with different languages and operating systems.

4 APPLICATION DETAILS

SE-VAULT is an online web-portal where not only technical but also mental health is also taken care of. As stated in [3], on a good day as a software engineer, not only coding but interaction of various levels is equally important. During the COVID-19 pandemic lockdown situation, everyone is confined to their own houses and working remotely. This can affect the mental well-being of the employees and thus results in reduced productivity. As per findings in [1], it is evident that stress level has been increased and on the other hand mentoring activity has been decreased. This situation is daunting for a newly graduated software engineer who has recently joined the company. If not properly guided by mentors and his team-members, the incoming developer might feel intimidated and marginalized. This can also result in creating a negative impression of the company. Thus, SE-VAULT can serve as a perfect good-to-have resource to help developers with not just technical aspects but also in

ensuring mental wellness through live Knowledge Transfer (KT) sessions.

SE-VAULT is catered not just to new graduates or developers but it could just turn out to be the platform which everyone needs during these tough times. Thus, they would be able to connect to the outer world and their colleagues to freshen up their tired mental state and get involved in fruitful conversations.

5 HIGH-LEVEL ARCHITECTURE DESIGN

SE-VAULT follows a mix of event-based and layered architectural design patterns. Since Python and FLASK are used for the back-end of the application, the architecture that we'll use will largely be the *Model-View-Template* (MVT). Main functionality will be written in the *View* part. Database schema will be designed in the *Model* part and front-end of the application will be in the *Template* files. Basically, whenever the user tries to access the website, the view will fire the required template allowing the user to see the appropriate template on the screen. For instance, when a user is not authenticated and is visiting the website for the very first time, the user will see the login page on the screen. This is because, in MVT design, every part of the architecture is a different entity which will provide us the required modularity for concurrent collaboration.

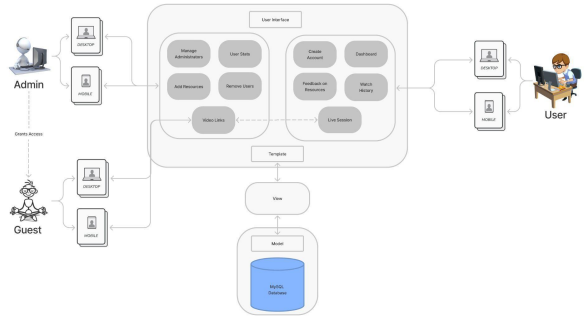

Fig1: *Architecture Design for SE-VAULT*

6 IMPLEMENTATION

6.1 Design Choices

SE-VAULT is a web application and therefore numerous web design architecture models were considered. MVT architecture was chosen as it has high modularity along with low coupling. The team incorporated pair programming to work on tasks.

The initial expected customer base was on a lower scale and thus MySQL database was our go-to choice. The second most important factor behind choosing MySQL was that it provides normalization of the data and subsequently eases querying by joining different columns to get results. The only downside of using MySQL is that it makes it nearly impossible to store videos directly in the database. To overcome this, instead of saving the whole video in the database, a link to the video was stored.

For back-end design FLASK web framework was chosen as it has an easy interface to code along with support for various essential plugins to connect to external entities. Python is one of the most popular programming languages and it supports popular front-end technologies like ReactJS and AngularJS. For connecting to our database, Python provides a wrapper package PyMySQL using which makes it easy to connect to a MySQL database.

6.2 Testing

The goal of the test phase is to ensure that the system built and tested in the development phase meets all requirements and design specifications.

In this project we incorporated both manual and automated testing. Automation testing was implemented with the Selenium package in Python. Specifically, we used the WebDriver module which is a cross-browser testing framework that is also open source. This framework essentially takes and transmits commands to the browser and also ensures that web-based applications function as planned. Another key benefit is that it is efficient and works with a variety of languages and operating systems.

The test automation framework incorporated is Behavior Driven Development (BDD) framework. This framework is chosen because it allows easy collaboration between developers and testers. This is especially useful as it mainly focuses on the user's needs. The test cases checklists for different users or testing roles like admin, user. It covers all the functional end-to-end aspects. The project covers both unit testing and user acceptance testing.

7 DEPLOYMENT

SE-VAULT can be deployed externally on cloud using Heroku or AWS. As the database size increases, it would become hard to handle such large data and query it efficiently. To deal with this issue we can use S3 buckets of AWS. If in future we decide to save the videos onto the database instead of the current way of storing links, using NoSQL databases such as Amazon DynamoDB would be effective as we can also scale the application horizontally. In case of unexpected overwhelming traffic, using AWS

Elastic Load Balancers would ensure that the website would be running smoothly without any delay in responses.

8 CONSTRAINTS

This web application has server constraints for streaming videos. If at one instance more than `10K+` users try to stream videos, then we will have to move to some higher end server capable of handling such traffic. Additionally, we are only permitting uploads in a limited number of formats.

9 LIMITATIONS

Due to time constraints, we could not focus on implementing hashing techniques to encrypt user passwords to maintain privacy and confidentiality. Apart from that, currently our application is not hosted in real-time and the videos are not stored in the database. For this, we plan to switch from MySQL to NoSQL database. Lastly, we are prioritizing the implementation of Live Streaming functionality and Hashing methods for ensuring privacy in a future release**.**

10 FUTURE WORK

Though our system is robust and fully functional, we believe there is still scope for improvement. We highlight some of our ideas below: -

1) Notification system according to the subscriptions of the user.
2) Support for fun mini-games, and connection to online streaming platforms.
3) Useful links to external references of various resources related to Software Engineering for anyone who wants to gain in-depth knowledge.
4) Coding challenges or hackathons to showcase the practical use cases.
5) Mobile app support along with the current web support.

CONCLUSION

SE-Vault is not just an e-learning platform; it is the best environment for software engineers to interact with and stay motivated. Our application provides easy access to learning materials which will help employees excel in their workplace. One unique characteristic that sets our application apart from others is that we laid special emphasis on ensuring the work-life balance of employees by incorporating recreational resources. Thus, our application acts as a “one-stop resource” for all software engineers to make learning efficient whilst serving both personal and professional development of employees. Even though there are limitations in the flexibility and features of the application, in future we plan to work towards deploying a version that is publicly accessible and serves customers in real-time.

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APPENDIX

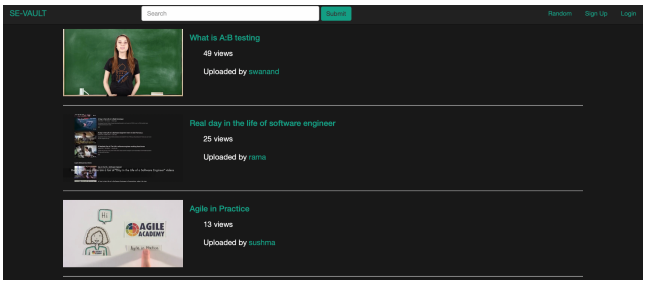

Fig2: *Dashboard in SE-VAULT*

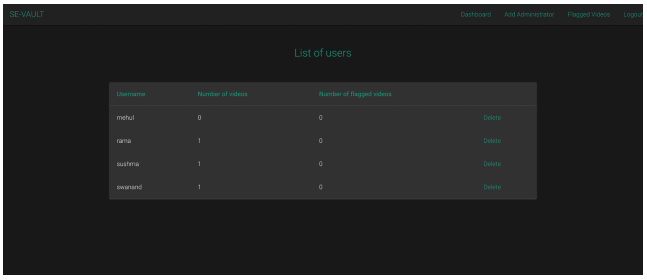

Fig3: *User Control page in SE-VAULT*

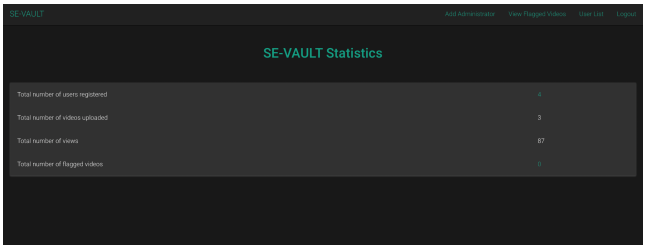

Fig4: *Stats page in SE-VAULT*

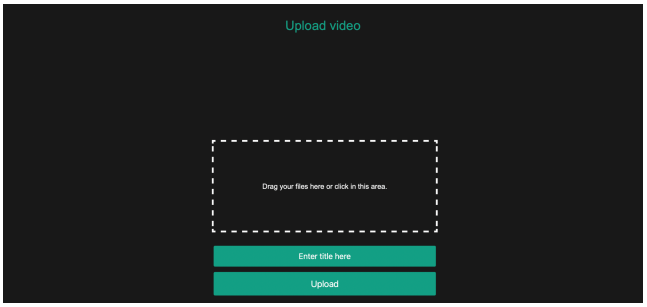

Fig5: *Upload a new video page in SE-VAULT*

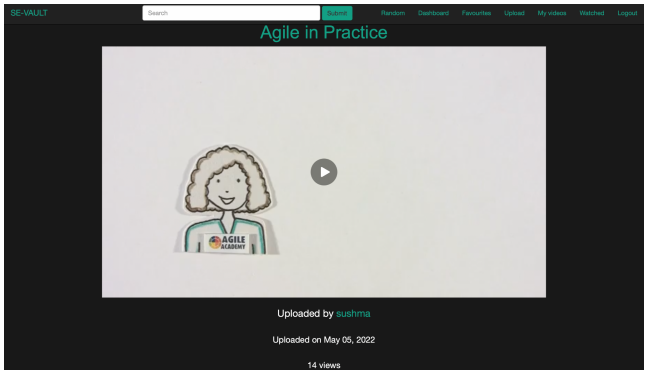

Fig6: *Streaming Video in SE-VAULT*