MSc Project - Reflective Essay

Project Title:	Designing and Building a Safe Students-Centric Social Network
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Digital connections have become an integral part of our lives today and social networking websites offer both possibilities and challenges for the younger generation. This essay explores the journey of concept conceptualizing, designing, and implementing a secure social networking platform for students. It delves into challenges encountered during this development process, technological solutions employed, and legal/ ethical considerations undertaken. Through an introspective lens, this essay not only examines the strengths but also critically reflects on weaknesses for identifying the areas of improvement for further possibilities of future work. With these stated ideas, I discuss the experience of creating a platform that balances social networking, concerns of safety as well as user data protection.

Analysis of strengths/weaknesses:

The "students social network" platform provides enhanced collaborative learning, peer-to-peer knowledge sharing, and academic discussions among them. It allows the users to find their fellow mates, socialize responsibly and get better in their academic endeavours. In his article, Emilio (2022) claimed that one of the main concerns with popular platforms like Twitter today is that they are filled with spam and phishing links, filled with Ads and sponsored messages, spoiling the entire user experience. The core strength of this platform is it is without bias, with content moderation and hate speech detection. This social media application has been designed to provide a clean user experience without any irrelevant content.

A critical design decision that I had to make to is to have a clear demarking between front-end and backend software. Currently, the app is developed with an API-first approach considering its benefits for desktop platforms and these functional APIs can be reused by different iOS / Android UI/UX clients for mobile native applications (Rivero, José Matías, et al, 2013). Software and security updates were regularly considered to keep the performance of the application at high standards. The software packages are constantly verified and updated with the latest packages so that any vulnerabilities are promptly addressed. Adhering to the industry's best practices and coding standards has been followed to ensure code quality, readability, and ease of maintenance. For instance, Error handling and logging mechanisms are added to provide valid error messages and triage application issues through prompt debugging. Implementation of practical error and exception handling are included to prevent app crashes and ensure graceful shutdowns.

Although the software application is fully functional with limited features developed within the stipulated time, it can be further developed with several useful functionalities. Some feedback from the application users was collected regarding new features that could be introduced as per the emerging trends. Features such as live notifications, tagging people, Searching and Filtering data could have made the application more interactive to use. For example, for a given small set of users during this project, the APIs are designed to return all the data from the backend to the client, and it does not take a toll on the performance now. But, once the app is set to serve a larger group of users, without

these optimizations such as searching and filtering data, it would take a longer time to fetch data from the system, which in turn would affect user experience. Since it's a students' centric platform, the group creation was set to public access by default without restrictions. But there could have been some more options to create closed groups with customised permissions among a few people. To offer more productivity to the users of the network, there could have been a provision to synchronize the events page and integrate it with personal calendars as a cross-application feature.

Personally, this project has been a great learning curve in terms of utilizing the learning that I had with modules in my previous semesters. Coming from an Electronics background in my bachelor's, this was an opportunity to put forth my gained skills in multiple facets of Software Engineering. With the fundamental knowledge of programming and computer architectures, this project paved the way to do a lot of research about software design principles, framework implementation, database modelling and designing responsive UI with dynamic libraries. This project tested the agility of my skills, and I was thrown with various challenges to get the application developed and running without any serious bugs.

Possible Future Works:

This project has been developed with minimalistic design, functionalities, and features within the available time. There is still a huge scope for this application to be added with many usable workflows in the future. As the app just allows only pictures to be added now, a provision to add links, file attachments and short-form video content could be incorporated since they are becoming very popular across social networking platforms. Haider et al (2021) stated that multifactor authentication has become essential today to fully eliminate unauthorized access to the accounts during the login. Adding this functionality would have added an extra layer of protection to the users' accounts as discussed in this research. Social networking websites are driven by algorithms that have a set of rules which ranks the available content to every user in their feed. These algorithms need to be constantly validated and updated to show more personalised content and ensure user engagement, and interactions in the platform.

Even though the app is accessible through browsers on both mobile and computers, the look and feel of the application could have been more aesthetic if it is completely mobile-centric as independent Android and iOS applications. The different implementation of the UI/ UX for each of these platforms and the rendering changes across devices of different display sizes needs more time to complete with perfection. People have moved away from traditional text messaging to more gamified private messaging today. Voice messages are also quite common now because of their ease to create and share in a quick time. I would have loved to add the facility of private messages through an encrypted channel with read receipts. The app is incorporated with the detection of unacceptable text content, currently, the users can report media content only manually to the admin for any action. Mahlangu (2018) has discussed about how cyberbullying could be stopped by further extending this process to identify all forms of content, restrict, and act automatically using image processing.

Given the performance, all resources are fetched every single time from the backend currently. This would affect the system when the user base enlarges as many people would be accessing the system at the same time. So, an in-memory database like Redis could have been added to the existing system, so that a fetched resource for a particular user is kept in the cache memory for a short period as mentioned by Shanshan et al (2016). When the client queries the backend again, it would be fetched from the Redis DB without having to query MySQL, essentially making the app more efficient in terms of speed and performance. Adding to that, some multithreading optimization could be identified for performance improvements in processing synchronous and asynchronous

operations. Asynchronous processing of implementation will allow parallel processing of services and make the system more efficient. Techniques such as lazy loading could be used to load UI components on demand, rather than loading it upfront to enhance the experience to the user. It is also important to see that students need the right guidance in their early years to follow a good career path and mentors can pave the way for students in attaining their goals. A few more dedicated sections such as Alumni Connect, and Careers Hub could have been developed to offer more services with specific goals. This would have allowed students to expand their network with industry professionals, and entrepreneurs to get the right help in taking important decisions using the experience of the right people.

Critical analysis of the relationship between theory and practical work produced:

The conceptual idea of the project is to develop an application that would allow students to connect with their peers, form groups, share information about academic collaboration, and feel safe in the student community. It is intended to promote active learning and be inclusive, and constructive among the students. It was also about accessing and keeping the user data private and secure without any compromise as well.

The practical application built is working as expected on the core objectives set as part of the theory, adding some nuances during the implementation would make the product even better. Having said that the application built has been used only by a smaller set of users and can be scaled as per the need. There was a clear objective to block all forms of inappropriate content, but with the time constraints, the software was able to detect and restrict just text content alone using the perspective API (Lees 2022). This poses a bit of a gap in the set objectives, but I had to take a hard decision considering the available time and resources. As I understood from this research by Emilio et al (2016), online platforms face the serious problem of having fake accounts posting harmful content all the time. This makes these platforms user-unfriendly and spoils the entire experience. To tackle the issue, the application users were mandated to have a unique institution code for registration initially to protect against bots and fake accounts making it a more tedious process.

In the beginning, it was meant to integrate all forms of multimedia content such as interactive quizzes, images, and videos to cater for a diverse learning experience. Although there were interactive options added to the platform, still some more of them could have made the experience on the platform even more enriching, simpler, and better. For instance, the user should be able to reply to a specific comment on a post, and then comment on the post itself, making it better for the users. Also, with the short attention span of people today, social media is about sharing stories, posts, and video content, and one key feature that I would have loved to add is the share feature for the users. The "people" tab in the platform was set to show people within the same courses for creating immediate connections. But this could have been more open with recommendations for establishing further connections in a broader community.

Additionally, the application restricts open access to the software systems by enforcing a token handshake among the client and the server interactions, validating the authenticity of the token and its expiry, mandate the user to log in once it's expired. But considering the ease of app utility, this process could be further levitated with a refresh token which allows the users to extend their online session without having to authorise login again. The infrastructure options, type and costs were not considered during the initial research, so I chose to store media images in the already available database rather than in an independent server considering the costs. These trade-offs had some effect on the product such as slower loading of images on the website. When the platform is signed up with more users, it will have to store the media in an independent server in Google Cloud storage than keeping it on the same database.

Awareness of Legal, Social Ethical Issues and Sustainability:

Legal awareness:

Data Privacy has been a major concern in public social media applications. Being the giant platform, Facebook has been often scrutinized by governments for mishandling user data for serving its business interests and has influenced democratic elections around the world. It paid a fine of about 725 million USD for a data breach involving Cambridge Analytica during the US elections in 2021 as noted by Jim et al (2018). To regain its reputation after failing in protecting customer data, Facebook had to rebrand itself to Meta and implemented stringent data privacy policies. The guidelines mentioned for the human right to privacy in Article 8 and the General Data Protection Regulations (GDPR) were adhered to during the development of this application. The personal data collected such as email, name and other information were protected as per compliance, and it is not retained with any third party (Bharti et al, 2022). Terms of service, privacy policy disclosure, copyright and intellectual property rights are informed to the users while signing up on the platform. I would have loved to automate to tool to report and handle any copyright violations, but currently, it is handled by the admin of the platform. These policies are constantly reviewed to stay aligned with updated laws and regulations.

Social awareness:

The application currently allows English as a language of operation, and it can be supported with multilingual content for assisting users from different regions and backgrounds. The app can also incorporate some niche features to ensure that it is fully accessible, supports users with any form of disability and be inclusive. The algorithm behind the app is transparent and does not work through bias towards any users of the platform. The app is designed to prevent harmful text content involving hate speech or cyberbullying. As claimed by Lees (2022), technology could be used to promptly restrict the content, disallow publishing it on the platform, and moderates the content to maintain a safe online community.

Sustainability awareness:

Given that the software does not consume energy directly, it is run and operated over multiple computing hardware that is resulting in increased carbon emission. Green computing principles are considered by designing reusable software. Abdel et al (2009) claimed that sustainability can only be attained by moving towards cloud computing for infrastructure resources while developing a software application. The application is currently containerized in the cloud as a shared resource in the form of pay per request model. This creates a virtualised environment depending on resource demand over an operating system, instead of requiring independent dedicated infrastructure.

Ethical awareness:

The important aspect while developing a social networking application is to ensure users' security. Hackers constantly look for loopholes to steal and sell customer data. Over the last few years, several businesses suffered losses due to security breaches as part of cyberattacks. It is recommended to hash users' password credentials during the registration and store them in the database. The hashed password is irreversible, and it cannot be compromised through these attacks. The application resources should be exposed to trusted resources and should identify and restrict all access to bots which could launch DDOS, spam, and phishing attacks to cause service disruption and cripple the system.

In conclusion, this journey of conceptualizing, designing, and implementing the application by myself, has not only enriched my technical skills through self-learning but has also equipped me with invaluable skills for my future career endeavours. I was able to build a secure social networking app with user-centred design, security and privacy realizing the significance of its existence for students today. It challenged and tested my ability to plan, analyse, implement, and deliver a functional product without any serious bugs. This revelation has given me the excitement to channel my upskilled knowledge into projects that resonate with my vision of using technology for the betterment of society. As I look ahead, I am certain that the insights and skills acquired in this process will provide a solid foundation for my future endeavours.

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