Software Development Internship: Employee Driven, AI Powered Newsletter

A Technical Report submitted to the Department of Computer Science

Presented to the Faculty of the School of Engineering and Applied Science

University of Virginia • Charlottesville, Virginia

In Partial Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

Benjamin Allen Tyeryar

Spring, 2024

On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

Academic Advisor: Nada Basit, Department of Computer Science

Software Development Internship: Employee Driven, AI Powered Newsletter

CS4991 Capstone Report, 2024

Benjamin Tyeryar
Computer Science
The University of Virginia
School of Engineering and Applied Science
Charlottesville, Virginia USA
bat8hgp@virginia.edu

ABSTRACT

The primary task during my time as an intern at a medium-sized technical consulting firm in Reston, Virginia, was to develop an internal tool for the company—an AI-generated newsletter application. Working as a developer on the intern team, I utilized the TypeScript-based Angular framework to develop the frontend of the application which was powered by a Node backend that integrated an API for AI. Database functionality, a big part of my purview, involved hosting and managing a MySQL database. In working towards the final product, my team utilized the scrum methodology, where I served as the scrum master for most of the development and acted as though the employees of the firm were the client. Following development, the application was made available to all employees who submitted their content. They were able to interact with other employees and view the AI-generated newsletter from the submissions. We held discussions about improved AI functionality and potential improvements to the product, including increased opportunities for employee interaction in the application.

1. INTRODUCTION

The onset of the COVID-19 pandemic in 2020 flipped virtually every aspect of daily life on its head. In order to adapt to the circumstances at hand and ensure public safety, many companies, including the Reston-based consulting firm I worked for as an intern, opted to move their business operations online and have their employees work from home. As conditions improved, many companies opted to hold onto the remote work arrangements, as they had come to appreciate its benefits in their day-to-day life.

As an intern last summer, I worked in a hybrid working arrangement, with three days in office, and two days working from home. Upon starting, it was clear that what once was a bustling, collaborative, and dynamic office environment was now a ghost town, with around 90% of its employees who were now working fully remote. Employees still in the office spoke with great nostalgia about the days when you could hardly find a desk to work at because the office was so crowded. It was this once-great sense of camaraderie that was now shared primarily through a screen that inspired my team of interns and me to develop our internal project for the summer.

Being tasked with developing an internal tool for the company, the team agreed that we wanted to develop an application that would encourage employees at the company to become invested in each other's work and

life even without short conversations at the water cooler. With this goal in mind, we decided to develop an AI-generated, employee-powered newsletter application. The goal of the application was to allow employees to share their experiences and stay connected with the happenings of their coworkers in a quick, easily digestible manner.

2. RELATED WORKS

In 2020, researchers conducted a study on Microsoft's shift from in-office work to a majority work-from-home setup as a result of the pandemic. Focusing on the relationships and connections between employees, their findings were very detailed but overall they noted: "Our results show that the shift to firm-wide remote work caused business groups within Microsoft to become less interconnected" (Yang, 2020). This study helped to confirm our assumptions about remote work negatively impacting relationships at companies, and motivated our team to pursue our project.

At the time of development, generative AI and LLMs were still a relatively hot topic, and our team had decided we wanted to integrate AI into our project. Most of the mainstream models we looked into, like Google's Bard and OpenAI's ChatGPT, did not suit our needs. However, after coming across Cohere, we had found the right AI for our needs. Drawn to the product by the ease of use, Cohere's competitiveness in the market as an enterprise option. as well as the models higher levels of accuracy against GPT 3, made it an easy choice for our project (MacManus, 2023)

3. PROJECT DESIGN

The development of the application took place over 8 week long sprints. After a period of planning and selecting the technologies that would be used to develop the application, we began development.

3.1 Application Workflow Overview

The newsletter application our team developed was based on one week cycles. During the week, employees would submit updates that included a title, body, and optional picture upload. These updates would then be available for all employees to view and discuss with other employees through a commenting system on each post. At the end of every week, all of the posts that had been made in the past week would be aggregated and summarized with AI to develop a more cohesive breakdown of the updates coworkers had shared in the past week. This newest iteration of the newsletter would then be displayed on the homepage of the application, and employees looking for a quick breakdown of all posts would be able to read what their coworkers had shared in the past week. Employees were able to moderate the comments others had made on their updates and were also able to view all of the past newsletters and see the posts that were included in those newsletters.

3.2 Client Specifications

The task of developing an internal tool for the company was relatively open-ended. Prior classes of interns had developed tools such as a coffee chat scheduler to promote cohesion among the employees at the company. When presented with the task, our team was also provided with some technical requirements for the application. First, our project had to be hosted internally, utilizing the company's on-site servers. Additionally, the project had to utilize a MySQL database that had been set up for our team on the company servers. Parts of the technical stack for the development of the project were also mandated by our supervisors, including the use of the Angular framework for the frontend and NodeJS for the backend.

3.3 Technical Stack

For the development of the frontend, Angular enabled our team to work quickly and efficiently in building out the web-facing portion of the application. Angular's usage of components allowed for uniform development, which was a concern going into the project as most of the team had not worked on a web development project collaboratively before. The ability to pull features that had already been completed and seamlessly add them to new pages on the application was extremely beneficial to the project.

In the backend, our team utilized NodeJS and express to power our business logic. Adhering to best practices within the company, our team opted to extensively utilize RESTful APIs in the backend. The usage of NodeJS helped to simplify the development of the front end processes as well, as JavaScript lends itself to simple use in HTML. By leveraging NodeJS alongside the express framework, we were able to implement a lightweight and efficient backend that seamlessly communicated with the frontend components.

The database powering the application was a MySQL database. In order to function more effectively in conjunction with our NodeJS backend, the Sequelize ORM was implemented, providing many useful features like models and simplified the creation of relations between tables. Given the short timeframe of development and the lack of familiarity with SQL databases from some of the team, Sequelize helped to ensure that all members were able to interact with the database in a timely manner.

3.4 Deployment

The requirement of utilizing the company's internal server to host the application proved to be an obstacle in the development cycle. With traditional cloud hosting services that our team was familiar with such as Heroku and Google Cloud Platform, CI/CD was a standard feature; however, without the use of this feature, our team needed to devise a way to deploy our application. Our solution was to develop a shell script that was executed using cron on our Unix server. At given intervals, the server would pull the code from the GitHub repository and re-deploy the application to the server, ensuring that the deployed version of the application always represented the latest changes.

3.5 External Tools

With AI being one of the core features to add value to the application, CohereAI was utilized to provide the AI functionality of the application. The service was accessed by a web-facing API, and our team utilized the free tier of the service as our application did not require constant access to the API, but instead only required a weekly access to generate the newsletter. In utilizing the API, our team provided an instruction sentence followed by the contents of the submissions from the employees at the company and received a response with a summary of the input—our newsletter.

Our team emphasized ease-of-use for the application, which led to our decision to implement Microsoft login for the users of the application. The company utilized Microsoft's suite for their business operations, and integrating the account system meant employees would not have to manage yet another username and password. The Microsoft Authentication Library (MSAL) was utilized to integrate login into the application.

4. RESULTS

Within the short development cycle, our team was able to implement the core features of our application and the web server was entirely functional. Employees were able to log in to the site with their company Microsoft accounts and create, view, and interact with updates on the site. The scheduled generation of the newsletter was observed to be correctly working once before the end of the internship.

Employees reported relative satisfaction with the application, and many stated they would try using the site. Around 100 employees attended the presentation of the application and logged onto the site. Our site did experience some difficulties in handling this much traffic, specifically in regards to the newsletter generation due to the large amount of submitted content not being able to be included in a single newsletter. Overall, the consensus among those working at the company was that the app had the potential to provide value amongst the employees and was clean, well developed, and adhered to brand guidelines.

5. CONCLUSION

The feeling of a remote workforce being disconnected from each other is not ample evidence to justify developing a tool for connecting the company. However, in reading literature surrounding remote work and collab one worth addressing. Through the conceptualization and development of the AI powered newsletter application, I was able to provide hard-working employees with a platform to build relationships with their coworkers in in order to foster a more productive work environment. While small in scale, the application successfully implemented relevant web development technologies and techniques, followed company best practices, and leveraged the power of third-party services.

6. FUTURE WORK

The newsletter web application set a strong foundation for further development of an application designed to bring employees closer together, and there are many improvements that could strengthen the application. The AI functionality of the application could be further integrated, and the quality of the usage could be improved. The development of a newsletter for individual employees based on their interests and their connections with coworkers would be a strong addition to the project, as well as implementation of an AI service provider better suited to the needs of the application. Another potential improvement of the application could include easier integration with existing technologies for the employees. For example, the application could feature a widget on commonly-used company pages to encourage employees to participate; or a mobile application could be developed. Many of these features were discussed throughout the development process, but were not implemented due to time constraints. The Employee Driven, AI Powered newsletter application serves as a solid stepping stone in navigating employee relationships in the age of remote work.

REFERENCES

Yang, L., Holtz, D., Jaffe, S., Suri, S., Sinha, S., Weston, J., Joyce, C., Shah, N., Sherman, K., Hecht, B., & Teevan, J. (2022). The effects of remote work on collaboration among information workers. *Nature Human Behaviour*, *6*(1), Article 1. https://doi.org/10.1038/s41562-021-01196-4

MacManus, R. (2023) *Cohere vs. OpenAI in the enterprise: Which will cios choose?*, *The New Stack*. Available at: https://thenewstack.io/cohere-vs-openai-

in-the-enterprise-which-will-cios-choose
/ (Accessed: 26 February 2024).