

Kudos Application

Project report submitted in partial fulfilment of the requirement for the
degree of Bachelor of Technology

in

Computer Science and Engineering

By

Utkarsh Singh (191224)

UNDER THE SUPERVISION OF

Dr. Pankaj Dhiman



Department of Computer Science & Engineering and Information Technology

Jaypee University of Information Technology, Wagnaghat

173234, Himachal Pradesh, INDIA

Candidate Declaration

I hereby declare that the work presented in report “Kuduos Application” in partial fulfillment of the requirements for the degree of Bachelor of Technology in Computer Science and Engineering submitted in the department of Computer Science & Engineering and Information Technology, Jaypee University of Information Technology is an authentic record of my own work carried out over from August 2022 to December 2022 under the supervision of Dr. Pankaj Dhiman, designated Assistant Professor (SG) of department Computer Science & Engineering and Information Technology.

Utkarsh Singh, 191224

This is to certify that the above statement made by the candidate is true to the best of my knowledge.

Dr.Pankaj Dhiman

Assistant Professor (SG)

Computer Science & Engineering and Information Technology

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Abstract

Kudos app is an innovative tools designed to enhance employee engagement and boost morale within organizations. These apps provide a platform for employees to acknowledge and appreciate the contributions of their colleagues, fostering a positive work culture. Managers may simply recognise and motivate their employees by using methods like peer-to-peer recognition. These programmes commonly include gamification elements such as badges or point systems to make recognition more participative and joyful. Furthermore, many employee recognition programmes include analytics and reporting features that enable employers to track recognition efforts and uncover patterns. Finally, these tools help to foster an appreciation culture, which leads to increased job satisfaction and productivity.

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Chapter 1: Introduction

1.1 Introduction

The Kudos App is a fantastic employee recognition tool that will change the way your company acknowledges and appreciates its employees. In today's competitive business market, employee appreciation is critical for building a great work culture, improving morale, and encouraging top performance. You may use the Kudos App to create an environment where employees feel valued, driven, and recognised for their accomplishments.

The Kudos App is primarily intended to enable employees to recognise and celebrate the accomplishments of their coworkers. Team members may simply express thanks, provide praise, and highlight remarkable performance using a user-friendly interface. Peer-to-peer recognition is not only encouraged, but also made simple, encouraging a spirit of camaraderie and collaboration throughout your organisation.

Managers have a critical role in fostering a culture of appreciation, and the Kudos App provides them with great tools to do so. Managers may publicly applaud their team members, highlight great performance, and offer personalised feedback with a few clicks. Managers may use the app's powerful capabilities to inspire their workers, promote great behaviours, and foster an excellence culture.

The gamification components of the Kudos App are one of its distinguishing features. Recognising that acknowledgment should be enjoyable and engaging, the app combines badges,

points, and leaderboards to make the process more participatory and competitive. This gamified method not only makes recognition more pleasurable, but it also motivates employees to actively engage in honouring the accomplishments of their colleagues.

Kudos App does more than just facilitate acknowledgment; it also includes strong analytics and reporting tools. Organisations may acquire important insights on recognition patterns, identify top performers, and measure the effectiveness of recognition programmes. This data-driven strategy enables you to make educated decisions, fine-tune employee recognition methods, and ultimately promote positive cultural development.

Security and privacy are of the highest concern, and the Kudos App was designed with strict safeguards in place to protect sensitive employee data. You may be certain that your workers' information is secure and handled with the utmost discretion.

The Kudos App installation is simple and straightforward. Our knowledgeable support staff will walk you through the onboarding process, ensuring a seamless transition and giving training to help you maximise the app's potential inside your organisation. The Kudos App is flexible and adaptive to match the particular demands of your organisation, whether you have a small team or a large workforce scattered across many locations.

Join the growing number of businesses that have recognised the value of employee appreciation with the Kudos App. Make your workplace a hotbed of appreciation, cooperation, and exceptional performance. Let us work together to create a culture in which people feel appreciated, motivated, and inspired to surpass expectations. Experience the Kudos App and discover your team's actual potential.

1.2 Problem Statement

- Traditional methods of employee recognition are insufficient in creating a culture of sustained appreciation and motivation.
- Lack of a centralized platform hinders effective recognition and celebration of employee achievements. Disconnect and low morale among employees due to limited channels for recognition.
- Absence of a system to track and measure recognition efforts impedes identifying top performers and aligning recognition with business objectives.
- Need for an innovative solution that empowers peer-to-peer recognition, enables managers to acknowledge exceptional performance, and fosters a culture of appreciation, collaboration, and motivation.
- A pressing need to enhance morale, increase employee engagement, and drive productivity and organizational success through a transformative employee recognition app like Kudos App.

1.2.1 Lack of Centralized Platform

The lack of a centralized platform for employee recognition presents several challenges that organizations face. These include:

- Recognition Efforts are Dispersed: Without a centralised platform, recognition efforts are dispersed across multiple channels, such as emails or informal ways. This dispersion

makes it difficult to reliably track and recognise deserving personnel.

- **Inconsistent Standards:** The absence of a centralised platform frequently results in a lack of standardised recognition criteria and standards. Inconsistency in the recognition process might lead to misunderstanding and injustice.
- **Limited Visibility:** Without a centralized platform, recognition efforts are confined to specific teams or departments, limiting visibility across the organization. This hinders cross-functional collaboration and the development of a cohesive, company-wide culture of appreciation.
- **Missed Opportunities:** Because acknowledgment is decentralised, it is easier for significant accomplishments or milestones to go undetected. Employees may feel undervalued as a consequence, which can have a detrimental influence on morale.
- **Tracking and Analytics Difficulties:** The lack of a centralised platform makes it difficult to adequately track and measure recognition efforts. Organisations struggle to recognise trends, evaluate the effectiveness of recognition programmes, and make sound decisions for continual improvement.

By addressing these challenges through the implementation of a centralized platform like the Kudos App, organizations can overcome these obstacles, promote consistent and fair recognition practices, improve visibility across teams, seize all recognition opportunities, and gain valuable insights to enhance employee engagement and satisfaction.

1.2.2 Tracking and Analytics Challenges

When an organisation lacks a centralised platform for employee appreciation, it has monitoring and analytics issues. One significant issue is data fragmentation, which occurs when recognition data is scattered over several channels, making it difficult to collect and integrate for analysis. This fragmentation makes it difficult for the organisation to acquire a full assessment of its recognition efforts. Furthermore, the lack of a centralised platform might lead to insufficient data sets, with some recognition events remaining unreported or untracked. This constraint prevents the entire breadth of recognition actions inside the organisation from being captured. human data collection exacerbates the situation further, as tracking recognition data is frequently collected through time-consuming and error-prone human operations.

Another issue to be concerned about is the platform's lack of centralised analytics and reporting tools. Organisations struggle to create substantial insights and comprehensive reports due to a lack of strong analytics technologies. Analysing recognition trends, patterns, and implications becomes challenging without the necessary analytical capabilities. The influence of recognition events on employee engagement, satisfaction, and organisational success is exceedingly difficult to assess. In the absence of monitoring and analytics solutions, organisations struggle to quantify the effectiveness of their recognition initiatives and make data-driven decisions for improvement.

Organisations may utilise a unified platform, such as the Kudos App, to overcome these issues. This sort of platform enables comprehensive data collection, accurate insights, and customizable reporting options. By offering a standard system for gathering and analysing recognition data, it enables companies to minimise data fragmentation. Organisations may

use the Kudos App to receive a full perspective of their recognition initiatives, assess the effect of those efforts, and make educated choices to boost employee engagement and happiness. The platform's powerful analytics features allow organisations to create relevant insights and detailed reports, allowing them to investigate trends and patterns. Organisations that utilise a unified platform, such as the Kudos App, may be able to overcome tracking and analytics problems, resulting in more effective employee recognition efforts.

1.3 Objectives

- **Enhance Employee Recognition:** The primary objective of the Kudos App is to enhance employee recognition within organizations. By providing a centralized platform for recognizing and appreciating employees, the app aims to create a culture of recognition and foster a positive work environment.
- **Foster a Culture of Appreciation:** The Kudos App aims to foster a culture of appreciation where employees feel valued and acknowledged for their contributions. The objective is to encourage regular and meaningful recognition among peers, managers, and teams, promoting a sense of camaraderie and motivation.
- **Improve Employee Engagement and Morale:** By implementing the Kudos App, organizations seek to improve employee engagement and morale. Recognizing and celebrating achievements through the app helps boost employee motivation, job satisfaction, and overall happiness at work.
- **Facilitate Peer-to-Peer Recognition:** One objective of the Kudos App is to empower em-

employees to recognize and appreciate their peers. The app facilitates seamless peer-to-peer recognition, encouraging a collaborative and supportive work culture.

- **Enable Managerial Recognition:** The Kudos App aims to enable managers to effectively acknowledge exceptional employee performance and demonstrate appreciation. By providing a platform for managers to give recognition and rewards, the app enhances the supervisor-employee relationship and strengthens leadership effectiveness.
- **Drive Performance and Productivity:** The Kudos App seeks to drive performance and productivity by recognizing and rewarding employees for their accomplishments. The objective is to create a positive reinforcement system that motivates employees to consistently deliver their best work.
- **Provide Insights for Continuous Improvement:** The Kudos App intends to provide valuable insights and analytics on recognition efforts. The objective is to enable organizations to measure the impact of recognition initiatives, identify trends, and make data-driven decisions to continuously improve their employee recognition programs.

These goals strive to establish a workplace where people feel valued, engaged, and driven, resulting in increased overall organisational performance and success.

1.3.1 Enhance Employee Recognition

Employee appreciation gets a timely boost from the Kudos App. Including numerous techniques, such as:

For consolidating and organizing data, the software serves as a centralized platform. Recognition activities must be managed effectively in order to initiate recognition program. Workers

have convenient access to well-arranged resources.

Through a handy application known as Kudos, coworkers can effortlessly show appreciation to each other. Enabling communication between superiors and subordinates, the interface is user-friendly. Based on specific details, one can send personalized greetings and expressions of gratitude. Behaviours or accomplishments.

Culture is nurtured through active promotion of peer-to-peer recognition. The Kudos App encourages appreciation and support among colleagues. It's an innovative way to foster positivity within the organization. Contributions can be recognized and valued by employees thanks to their ability to be empowered. Strengthening relationships and morale, their colleagues were able to achieve as well.

Managers can utilize the app to recognize and reward exceptional employee performance promptly. This managerial recognition reinforces positive behaviors, motivates employees, and fosters a sense of value and appreciation.

Exceptional work can be recognized and rewarded by utilizing the app managers have access to. Promptly recognizing employee performance is important. It reinforces managerial appreciation. Fostering a sense of value, motivating employees, and encouraging positive behaviors are all key components of a successful workplace. Appreciation and of utmost importance.

Within the Kudos App, rewards and badges are customizable. Their unique values can be aligned with recognition by allowing organizations. Culture and customization come hand in hand, adding a unique touch that increases relevance. Recognition is a valuable way to show appreciation to employees. It can be a powerful motivator, as employees feel that their hard work and contributions are being noticed and valued. By acknowledging their efforts, employ-

ees are more likely to continue giving their best efforts. Additionally, recognition can create a positive work environment, leading to increased job satisfaction and a sense of ownership in the company's success. Overall, the act of recognition is vital in maintaining a happy and productive workforce.

Incorporated into the app is a recognition feed that allows coworkers to celebrate each other's accomplishments. congratulate publically and celebrate their colleagues for their achievements Fostering a sense of community is an achievement in and of itself. By creating a unique atmosphere, accomplishments can be celebrated in a way that is both distinct and memorable. Environment positive, work.

Kudos App furnishes data analytics and insights, promoting Their effectiveness and impact can be measured by organizations. Approaching recognition through data analysis is an effective method. By implementing recognition programs, businesses can gather valuable insights. levels of engagement assessment, trends identification, and Improvement is achieved through informed decisions.

Through these mechanisms, the Kudos App facilitates and enhances employee recognition, creating a workplace environment where employees feel valued, motivated, and appreciated for their contributions.

1.3.2 Foster a Culture of Appreciation

Developing through its main features and functions, the Kudos App possesses Inside an organisation, cultivating a culture of appreciation can have a significant impact. Appreciation is the key to a positive workplace environment that fosters productivity and job satisfaction. Teams that value one another, are grateful for each other's contributions, and consistently provide

recognition for a job well done, lead to happier employees. In turn, employees are more motivated to perform at their highest levels, resulting in better job performance. This appreciation culture can be achieved through regularly scheduled team-building activities and encouraging open communication channels. Nurturing a culture of appreciation takes effort and commitment but ultimately leads to a more successful and fulfilling work environment.

The app's user-friendly and streamlined delivery is a good place to begin. Recognition and appreciation platform for staff.

Peer recognition is promoted by the Kudos App. Using the app allows for the encouragement of such recognition. Respect and recognition of individual achievements and efforts must be acknowledged by the employees. Collaborative work is fostered amongst colleagues, leading to a supportive atmosphere. environment.

Regular and timely recognition is made by the app. Third, this happens. The app may be utilized by employees for providing swift feedback. Recognition must occur promptly and be certain that no delay occurs. overlooked.

Transparency and visibility are promoted by the app. Social recognition feeds allow employees to receive recognition in a convenient manner. These recognition efforts are an essential aspect of maintaining employee morale. Peers are publicly congratulated and celebrated, fostering a feeling of camaraderie. Behaviors that are positive are reinforced by a community.

By leveraging these features, the Kudos App creates an environment where appreciation is encouraged, recognized, and celebrated. It establishes a culture where individuals feel valued, motivated, and inspired to excel, ultimately fostering a culture of appreciation within the organization

1.3.3 Improve Employee Engagement and Morale

Employers may personalise recognition to their own ideas and culture using the app's customization capabilities, making it more meaningful and relevant to workers. Individualization fosters sentiments of belonging and participation.

The app's social recognition stream raises exposure and encourages employees to openly recognise and thank their teammates. This creates a pleasant and friendly working atmosphere, which boosts engagement and morale.

Furthermore, the Kudos App provides insights and data on recognition actions, allowing organisations to evaluate the performance of their recognition initiatives. This data-driven approach supports in the identification of development areas, resulting in enhanced engagement and morale.

Overall, the Kudos App serves as a catalyst for increasing employee engagement and morale by facilitating continuous acknowledgment, establishing a cheerful work environment, allowing for rapid feedback, and giving configurable choices that are aligned with company values.

1.3.4 Facilitate Peer-to-Peer Recognition

The initiative is built in such a manner that employees can simply and quickly distinguish their colleagues. It removes bottlenecks and streamlines the procedure, making it easier for individuals to express their gratitude and acknowledge their colleagues' efforts.

Employees may provide instant feedback and thanks to their peers by using the Kudos App. This rapid recognition builds an appreciation culture and produces a positive feedback loop inside the company.

Employees may utilise the app to personalise their messages and acknowledgements, making them more relevant and particular to the recipient's accomplishments or activities. This provides a personal touch while also magnifying the effect of peer-to-peer acknowledgment.

Do you have a recognition program in place? If not, it's time to start building a business case for one. If you do, does your program include peer-to-peer recognition? Organizations that include peer-to-peer recognition as a component of their overall recognition initiatives rate their programs as more effective than those that don't. Also, it's important to note that nearly two in three organizations include peer-to-peer recognition in their program. Your recognition tools must make peer-to-peer recognition fun and easy for employees—with the ability to send recognition from anywhere, anytime. It also should promote your company values by enabling employees to tie each recognition to a particular value. Peers who recognize each other publicly for activities related to core values inspire others to do the same.

Recognition platforms that give users the opportunity to send real-time, public recognition from anywhere is particularly valuable. The software should also provide data and insights that help continuously improve your program.

1.3.5 Enable Managerial Recognition

The Kudos App promotes management recognition by offering a venue for managers to acknowledge and appreciate the accomplishments and efforts of their team members.

Managers may create recognition messages and send them directly to team members, providing a more personalised experience that underlines the employee's value and importance to the company.

Reflective recognition gives you, the leader, a window into what matters most to another

person while at the same time, helping employees get present to their own progress and accomplishments. What's more? When employees stop and reflect on their own achievements, how they've tackled challenges, and how they've made progress, it is great for engagement, too. Research shows that when we make progress towards goals that matter to us, we feel motivated to continue. In other words, reflecting on even small wins can motivate employees to get more done. The best part? It is extremely simple, requires no preparation, costs nothing, and makes a world of difference for both parties.

There are three steps in reflective recognition which, to the employee, is going to just look like a simple conversation.

The Kudos App encourages managers to actively connect with their team members and develop a culture of recognition and support inside the organisation by offering a platform for management acknowledgment. This acknowledgment boosts staff morale, motivation, and work satisfaction, leading in higher productivity and overall organisational success.

1.3.6 Drive Performance and Productivity

Employees are encouraged to perform their best by giving a forum for acknowledgment and gratitude. Using the app to recognise and congratulate successes provides a positive reinforcement system that pushes people to strive for greatness in their profession.

Through peer-to-peer recognition, the app develops a culture of cooperation and support. Employees that acknowledge and celebrate the successes of their coworkers foster a sense of togetherness and collaboration, which improves performance and productivity.

Setting a target gives a purpose and a meaning and sets the direction for everyone. The absence of, or ambiguity in goals, can lead to confusion or misunderstanding and bad perfor-

mance. Performance systems and processes can be unforgiving if set too rigid. Instead, performance expectations should be communicated through the lens that a continuously evolving new normal demands. They should focus on shorter term prioritisation of workflow rather than long term goals, susceptible to change. An annual goal sheet/target may be set to provide direction for the employees, but these can be reviewed quarterly and improvised periodically to keep pace with the dynamic environment. Flexi goal setting with multiple short review cycles provide opportunities for employees to adjust their goals and identify ways they can upskill to remain relevant in the new work environment.

1.3.7 Provide Insights for Continuous Improvement

The software gathers and assesses recognition data using its data analytics capabilities, giving organisations with important insights. These insights aid in the identification of trends, patterns, and opportunities for improvement in recognition initiatives and practises.

Investigating recognition actions may assist firms in improving their knowledge of employee engagement, motivation, and satisfaction. This data might be used to influence the creation and refining of programmes aimed at improving employee recognition and overall organisational performance.

Businesses may use the Kudos App to monitor the effectiveness and impact of their award initiatives. By assessing data on recognition frequency, types of recognition, and recipients, organisations may analyse the success of their initiatives and make data-driven decisions to enhance their recognition efforts.

In addition, the Kudos App delivers insights into the most acknowledged and appreciated behaviours and accomplishments. Organisations may adjust their recognition programmes to

match employee preferences and values by determining which sorts of acknowledgment are most appealing to workers.

Overall, the data and insights offered by the Kudos App allow companies to assess and enhance their employee appreciation actions on a regular basis. Organisations may use this data to make better decisions, enhance processes, and foster a culture of continuous improvement and excellence.

Chapter 2: Literature Survey

Adamopoulou et al. [1], Chatbots are computer programs designed to simulate human conversation through text or voice-based interactions. They utilize natural language processing (NLP) and machine learning algorithms to understand user queries, provide relevant responses, and perform specific tasks.

Jordan Walke et al. [2], React.js is an open-source JavaScript library used for building user interfaces (UIs) for web applications. It was developed by Facebook and is widely adopted by developers and organizations for its efficiency, flexibility, and reusable component-based architecture.

RMS et al. [3], Emacs is a highly customizable, extensible, and powerful text editor primarily used for programming and text editing tasks. It was originally developed by Richard Stallman in the 1970s and has since evolved into a versatile tool with a dedicated user community.

Eelco Dolstra et al. [4], Nix is a purely functional package manager and build system designed to provide reliable and reproducible software environments. It was developed with a focus on declarative and immutable principles, making it a powerful tool for managing software dependencies and configurations.

Chapter 3: System Development

3.1 Overview

The Kudos Program produces a variety of interrelated content to create a powerful and meaningful way to get to know employees. Accessing and using the Kudos app is possible from the frontend, which gives users intuitive access. It allows users to manage their profiles, receive social suggestions and send thank you messages.

Including user authentication, recognition storage, and retrieval, the app's backend manages the essential functions. Securely stored in the database are user profiles, recognition data, and other pertinent information with which it communicates.

Microservices, in the form of functions, are utilized within a serverless framework to manage an array of app functions and services. Tasks, such as recognition submission, social feed updates, and user authentication, are all tackled by these individual functions. As events occur, they automatically trigger the appropriate function, which dynamically scales to accommodate demand.

The performance of the Kudos application is guaranteed by the serverless architecture, which allows resources to be automatically scaled according to customer demand and growth. The scalability of this application can accommodate a large number of people and traffic, to ensure efficient operation. Its design makes Kudos App usable by many users. The operation of the application is monitored and recorded to detect outages or problems and to understand the

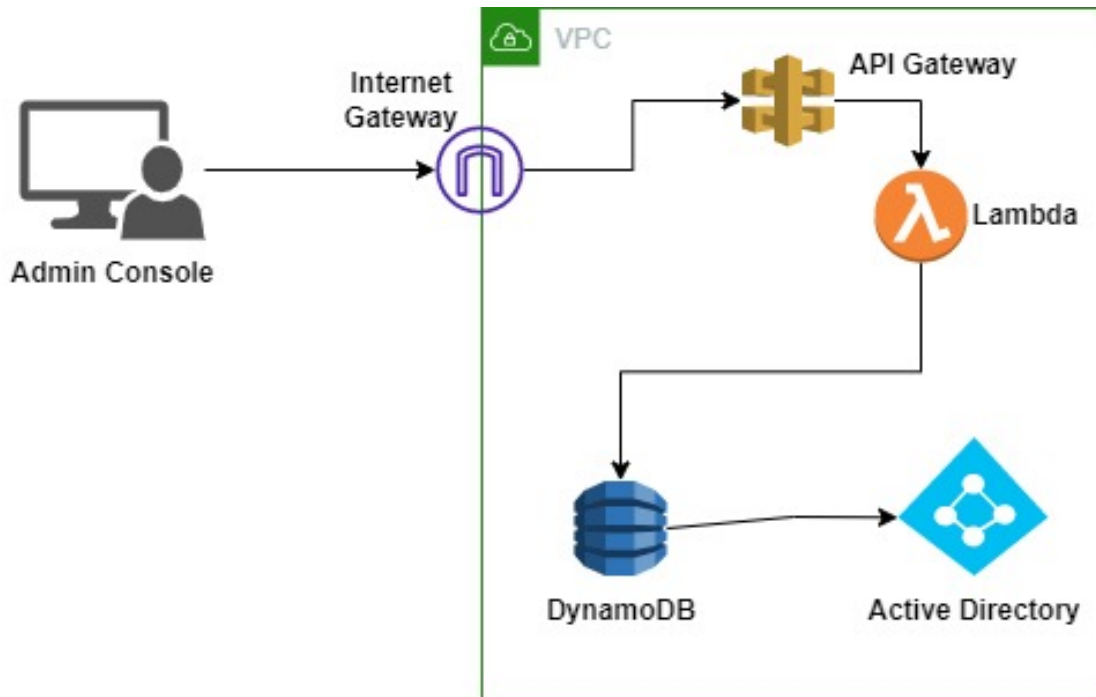


Figure 3.1: Admin Flow Diagram

behavior of the system. Using this information, you can solve problems, increase productivity, and keep improving the app.

By collaborating with external services, the Kudos App can improve its effectiveness. One such collaboration might involve teaming up with communication tools like email or chat platforms, facilitating the process of sending notifications and alerts to individuals. Analytical integrations can furnish valuable insights concerning engagement levels, performance metrics, and activities related to recognition. Furthermore, partnering with rewards providers will enable the Kudos App to manage and distribute tangible rewards or incentives to employees, thereby promoting recognition. These integrations serve to enrich the Kudos App's capabilities, giving users a more comprehensive recognition experience.

Security measures, including encryption of data in transit and at rest, user authentication, and access control, are implemented to safeguard sensitive information and protect the privacy

of users.

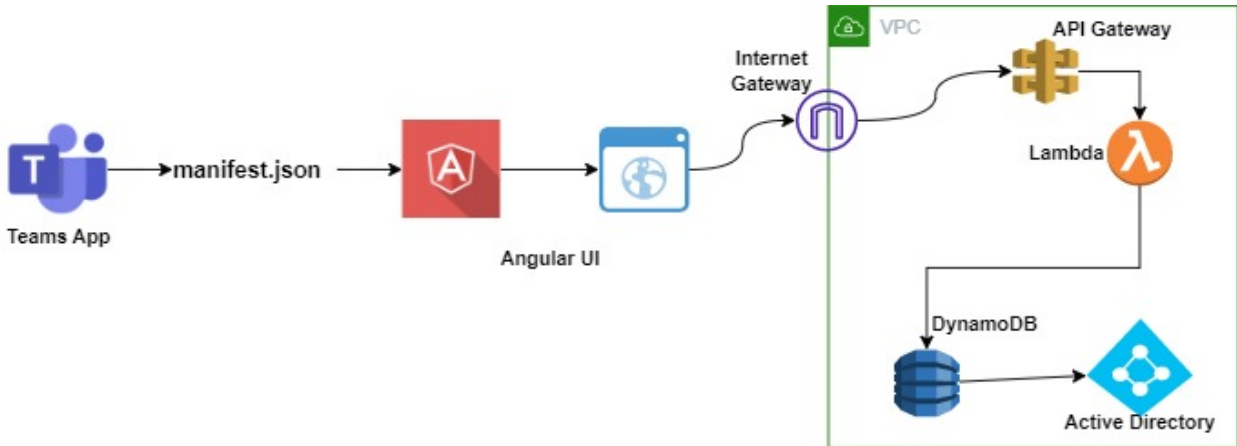


Figure 3.2: User Flow diagram

The optimal performance of the Kudos App is guaranteed with its serverless architecture that allows automatic resource scaling according to demand and increasing user activity. Large crowds and spikes in traffic can be accommodated by this app's scalability, assuring responsive operations. Its design ensures that the Kudos App remains capable of accommodating a large number of users over time.

The app's functioning is closely observed and recorded to detect hitches or hindrances and gain an understanding of the system's conduct. Using this information, one can problem-solve, enhance efficacy, and make incessant enhancements to the app.

Automated processes are utilized to streamline the development and release of software by utilizing continuous integration and deployment practices.

3.2 Frontend

Kudos app front end is built using Angular, a popular JavaScript framework for building dynamic and responsive web apps. Angular provides frameworks and functionality for front-end development by providing a wealth of frameworks and tools that help create a seamless user experience.

Angular follows an object-oriented model where the user interface is separated into reusable and standalone objects. Each component represents part of the application's functionality; covers its own HTML templates, CSS styles, and business logic . This modular approach improves code reusability, security, and scalability.Kudos frontend leverages Angular's powerful data binding capabilities to provide updating and real-time user interface. Two-way data binding enables automatic synchronization between the application's data model and UI elements.

Angular's routing mechanism is used to create a navigable app model with multiple views. Routers allow users to track between different applications using the URL protocol.This can perform functions such as user information, email confirmations, social recognition and gift management, all represented by one interface.

Kudos frontend leverages Angular's powerful template system to define the structure and layout of your app's UI . Angular templates use HTML syntax, enhanced with additional features such as comments, document binding clauses, and event handlers. This reporting method simplifies the UI development process and allows the creation of dynamic and interactive UI components .

For clear design and ease of use, use Angular Material, the UI component library. Angular Material provides pre-designed and updated UI components based on Google's Material de-

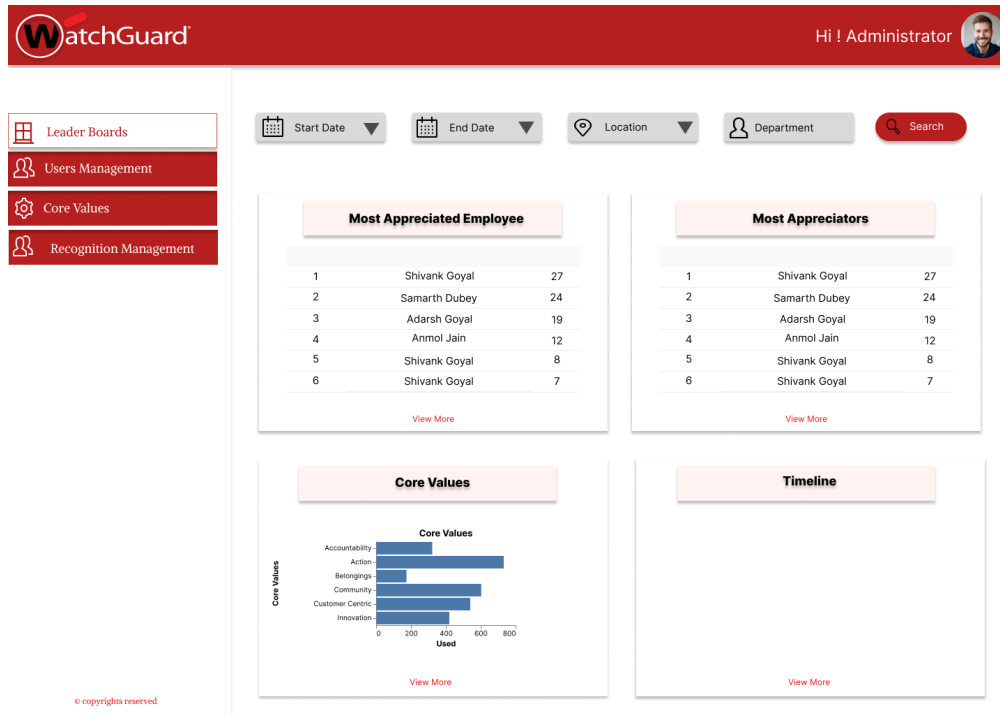


Figure 3.3: Admin dashboard

sign pattern. These products provide visual satisfaction and customer satisfaction by providing consistent design and behavior across different devices and screen sizes. In a nutshell, Kudos frontend is built with the advantages Angular gets from the object-oriented design of the framework, its data binding capabilities, the routing mechanism, the template rendering system, and many other directives, and services. Combined with the use of Angular Objects, these features allow to create responsive, dynamic and visual user interfaces for Kudos applications.

Angular also provides a rich set of built-in directives and services that enhance the functionality of the Kudos App. Directives like ngFor and ngIf enable iteration and conditional rendering of UI elements, while services such as HttpClient facilitate communication with the backend API for data retrieval and submission. These features contribute to the overall functionality and user experience of the Kudos frontend.

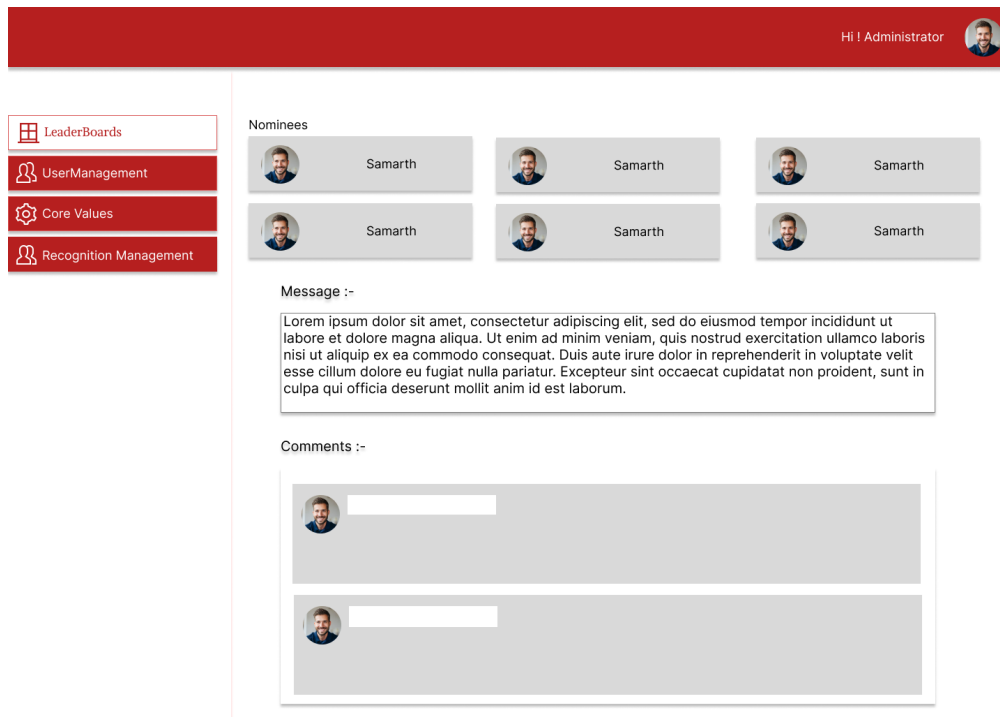


Figure 3.4: Userview

To ensure a responsive and mobile-friendly design, Angular Material, a UI component library, can be utilized. Angular Material offers pre-built and customizable UI components following Google's Material Design principles. These components provide consistent styling and behavior across different devices and screen sizes, resulting in a visually appealing and user-friendly interface.

In summary, the Kudos frontend built with Angular benefits from the framework's component-based architecture, data binding capabilities, routing mechanism, template system, and a range of built-in directives and services. These features, combined with the use of Angular Material, enable the creation of a responsive, modular, and visually appealing user interface for the Kudos App.

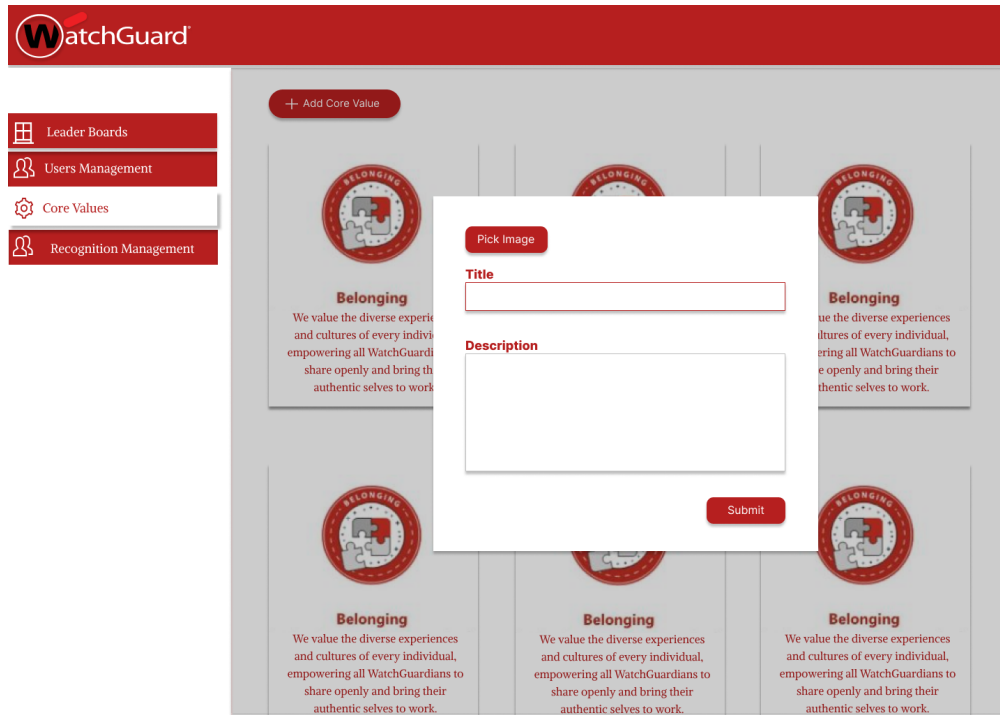


Figure 3.5: Appreciation

3.3 Integration Bot

Bot integration with Microsoft Teams allows integration of and interaction between bot and Microsoft Teams platform. Microsoft Teams is a collaboration platform that enables teams to communicate, collaborate, and access multiple tools and services in a single interface. Embedded Bots act as assistants in Microsoft Teams, providing users with important information, tasks, and supporting communication and productivity. It takes advantage of the Microsoft Bot Framework capability, which simplifies the development of chatbots. Integration Bots leverage the Microsoft Teams API to create connections and interact with the Teams platform. Thanks to this integration, the bot can send and receive messages, respond to the user's questions, and perform tasks based on user commands.

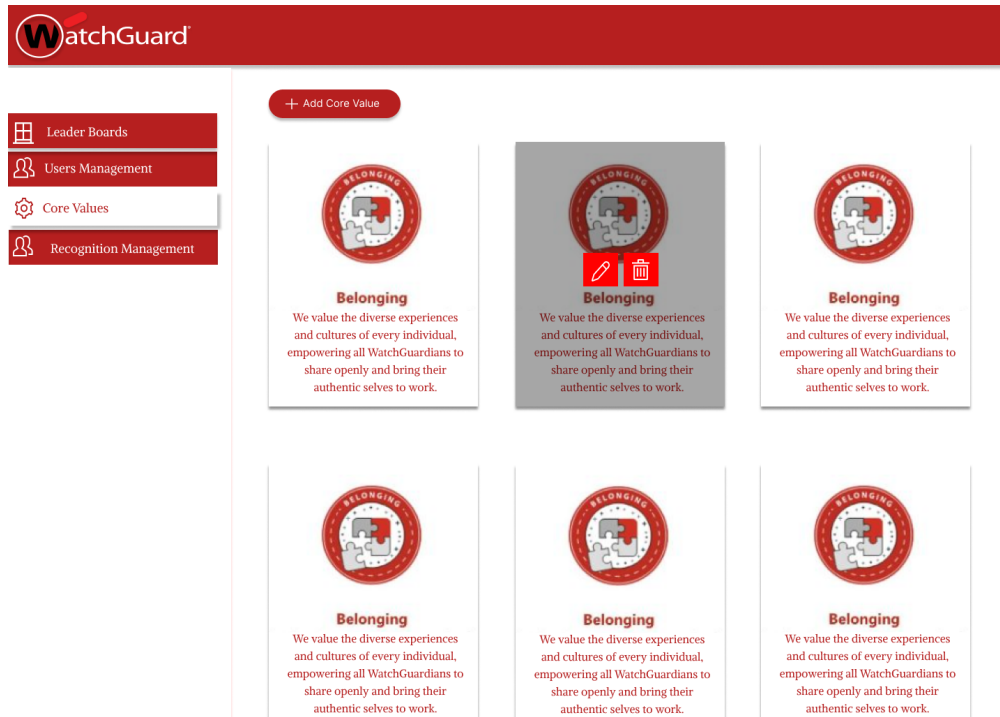


Figure 3.6: Employees Badges

When a user interacts with a bot in Microsoft Teams, the bot receives messages from users via the Teams API. The bot can process messages using natural language processing (NLP) to understand the user's intent and provide relevant information. Depending on the user's question or message command, the robot can do different things or provide relevant information. Integration bots can respond to users' messages in real time, give instant recommendations or perform requested tasks. They can display rich content such as cards, buttons or images to improve the user experience in the Teams interface. The bot can also send messages to users, start a chat or provide timely notifications. In addition, integration bots can use Microsoft Graph API to access and interact with various Microsoft 365 services and data. In the instance, the user can store their data, access the calendar, retrieve files from OneDrive or SharePoint, and perform other tasks in the Microsoft 365 ecosystem. This integration increases productiv-

ity and collaboration by enabling bots to deliver personal information and content to users. Security and authentication processes are important aspects of integrating Bot with Microsoft Teams. A bot must authenticate on the Teams platform to establish a secure connection and ensure that it interacts only with authorized users and resources. Microsoft Teams provides multiple authentication methods, including OAuth 2.0, to authenticate and authorize the bot.

When a user interacts with the bot in Microsoft Teams, the bot receives the user's message through the Teams API. The bot can then process the message using natural language processing (NLP) techniques to understand the user's intent and extract relevant information. Based on the user's query or command, the bot can perform various actions or provide relevant information.

The integration bot can respond to user messages in real-time, providing instant feedback or performing requested tasks. It can display rich content, such as cards, buttons, or images, to enhance the user experience within the Teams interface. The bot can also send proactive messages to users, initiating conversations or providing timely notifications.

When a user interacts with a bot in Microsoft Teams, the bot receives messages from users via the Teams API. The bot can process messages using natural language processing (NLP) to understand the user's intent and provide relevant information. Depending on the user's question or message command, the robot can do different things or provide relevant information.

To ensure a responsive and mobile-friendly design, Angular Material, a UI component library, can be utilized. Angular Material offers pre-built and customizable UI components following Google's Material Design principles. These components provide consistent styling and behavior across different devices and screen sizes, resulting in a visually appealing and user-

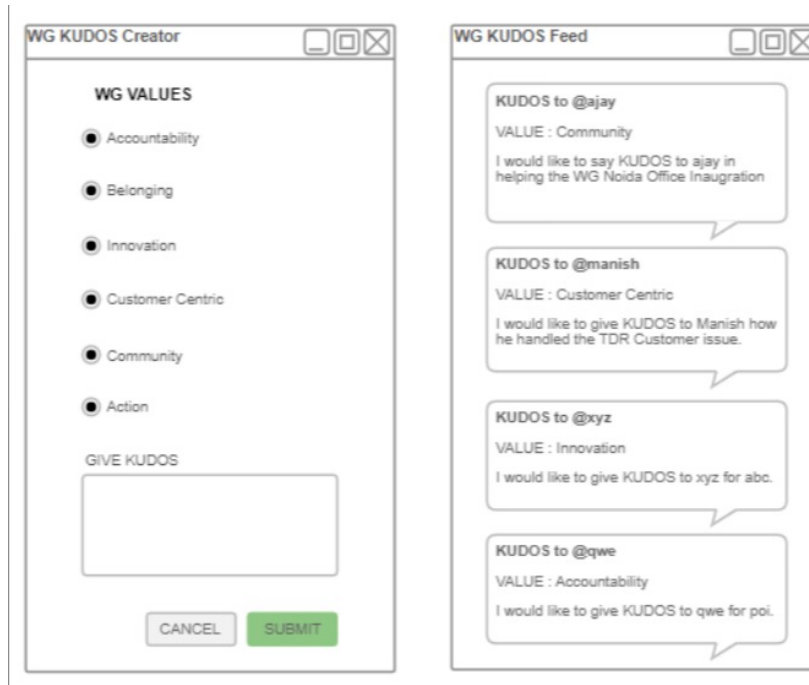


Figure 3.7: Wireframe

friendly interface.

The Bot Framework is a comprehensive development platform offered by Microsoft that empowers developers to create intelligent and conversational bots across various platforms and channels. It provides a wide range of tools, software development kits (SDKs), and services to facilitate the creation, deployment, and management of bots.

The Bot Framework is built on the Bot Builder SDK, which is available in a variety of programming languages such as C#, JavaScript/Node.js, and Python. This SDK offers developers a complete set of libraries, classes, and tools to aid in the building of bots. It supports user interactions, dialogue implementation, conversation flow control, and integration with third-party systems. The SDK also supports natural language understanding (NLU) capabilities through services such as LUIS (Language Understanding Intelligent Service) or QnA Maker, allowing bots to comprehend user input and deliver relevant responses.

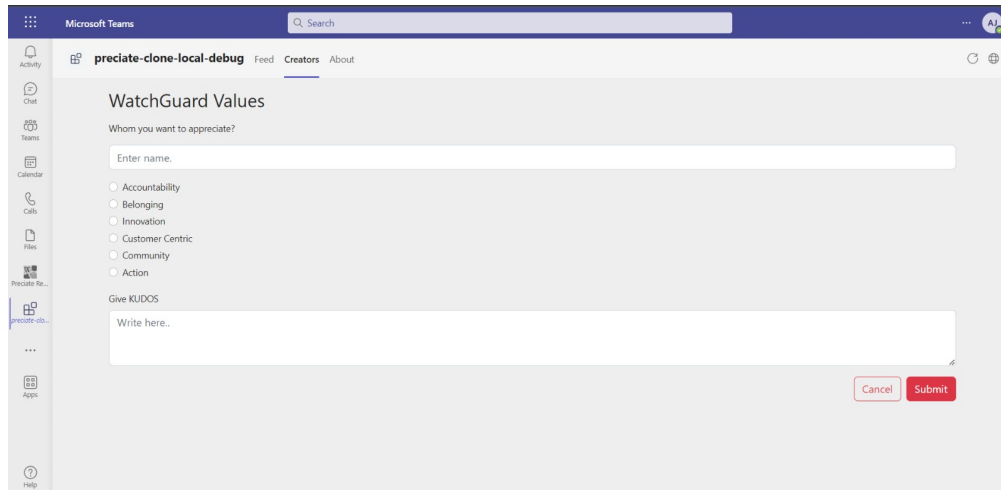


Figure 3.8: Microsoft Teams Bot for Kudos App

The Bot Connector service, which serves as a conduit between the bot and different communication channels, is a critical component of the Bot Framework. It enhances communication and message routing by allowing the bot to receive and send messages across many platforms, such as Microsoft Teams, Skype, and Slack. Bot Connector abstracts the complexities of channel-specific APIs, resulting in a standardised interface for bot-to-channel communication. This enables developers to construct their bots once and simply deploy them over other channels.

For each interaction between the user and the bot, an activity is produced. When a bot receives an activity, it passes it on to the activity handlers. For further details, see bot activity handlers.

Bots are conversational interface programmes. To communicate with a bot, you can use text, interactive cards, or speech. A bot behaves differently in a channel or group chat conversation than it does in a one-on-one contact. Conversations are handled through the Bot Framework connection. See Conversation Fundamentals for more information.

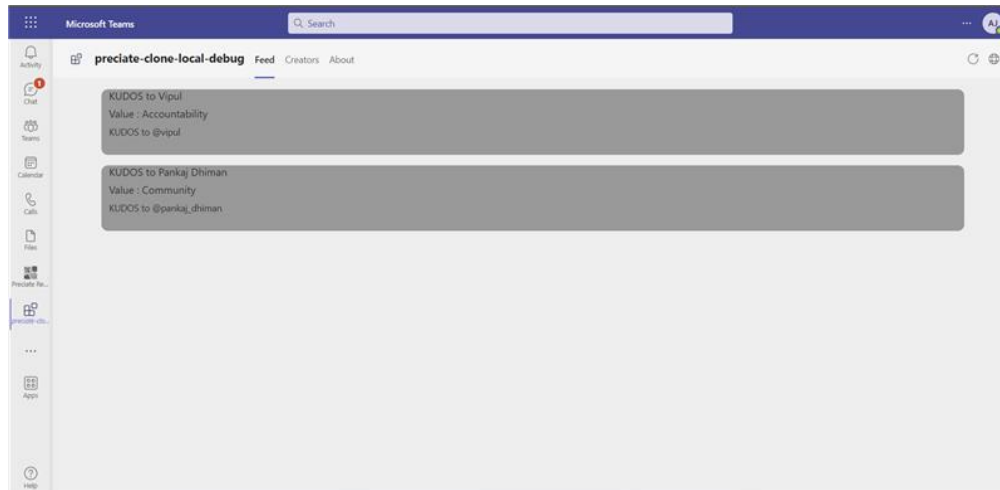


Figure 3.9: Microsoft Teams Bot for Feeds page

Your bot requires contextual information such as user profile details to access relevant stuff and optimise the bot experience. Also also get Teams context.

Rate limiting is used to optimize bots used for your Teams application. To protect Teams and its users, the bot APIs provide a rate limit for incoming requests. See optimize your bot with rate limiting in Teams.

With Microsoft Graph APIs for calls and online meetings, Teams apps can now interact with users using voice and video. See calls and meetings bots.

You can use the Teams bot APIs to get information for members of a chat or team. See changes to Teams bot APIs for fetching team or chat members.

This template has a variety of software, including bots, chat extensions, and tabs. Teams Toolkit integrates with the popular code editor Visual Studio Code, allowing developers to build, test, and publish Teams apps directly from the editor. Native Debugging: This tool gives developers with a native debugging environment to test their apps before publishing them to Microsoft Teams. This accelerates the development process and helps developers to notice and

resolve mistakes faster. Authentication and Authorization: The Teams Toolkit supports Microsoft authentication and authorization, making it simple for developers to secure their apps and protect user data.

3.4 Microservices

The microservice architecture of Kudos software emphasises flexibility, scalability, and management by breaking the programme into discrete, loosely linked services. Although each microservice runs independently, it focuses on a specific business feature and interfaces with other services via a well-structured API.

The user service is an essential component of the architecture. This microservice is in charge of user tasks including authentication, registration, and profile management. maintains user data, such as personal information and preferences, and offers APIs for user functionality. Another critical microservice is the authentication service, which manages the authentication procedure in Kudos applications. Manages event development, deployment, and recovery.

The services also provide the ability to maintain recognition history, manage badges or awards, and generate information about acknowledged employees.

The user service is an important part of the architecture. This service handles user-related tasks such as registration, authentication, and profile management. User information such as personal information, preferences, and access credentials are kept. User Services provides a consistent user experience by allowing users to utilise APIs to register, log in, and edit their profiles.

```

public class Notification {
    ...
    public Notify createNotify(long consumerId, long restaurantId,
                               List<MenuItemIdAndQuantity> lineItems) {
        Restaurant restaurant = restaurantRepository.findById(restaurantId)
            .orElseThrow(() -> new RestaurantNotFoundException(restaurantId));

        List<NotifyLineItem> notifyLineItems = makeNotifyLineItems(lineItems, restaurant);

        ResultWithDomainEvents<Notify, NotifyDomainEvent> notifyAndEvents =
            Notify.createNotify(consumerId, restaurant, notifyLineItems);

        Notify notify = notifyAndEvents.result;
        notifyRepository.save(notify);

        notifyAggregateEventPublisher.publish(notify, notifyAndEvents.events);

        NotifyDetails notifyDetails = new NotifyDetails(consumerId, restaurantId, notifyLineItems, notify.getNotifyTotal());

        CreateNotifySagaState data = new CreateNotifySagaState(notify.getId(), notifyDetails);
        createNotifySagaManager.create(data, Notify.class, notify.getId());

        meterRegistry.ifPresent(mr -> mr.counter("placed_notifys").increment());

        return notify;
    }
}

```

Figure 3.10: Notification Class

These microservices collaborate to provide a comprehensive and scalable employee recognition system. They communicate with one another using well-defined APIs, which results in easy integration and interoperability. The microservices architecture enables rapid development and maintenance of the Kudos app by giving for the flexibility of scaling individual services based on demand.

These microservices collaborate to provide analytics specialists with a comprehensive and scalable solution. It communicates with using a set of well-defined APIs, enabling effective integration and compatibility. The microservice architecture allows individual services to be switched on and off as needed, boosting the efficiency and upkeep of Kudos applications. Information Services is another key microservice in the architecture. The Kudos app is in charge of managing the authentication process. This service handles the creation, exporting, importing, and retrieval of authentication files. It allows users to recommend friends or coworkers

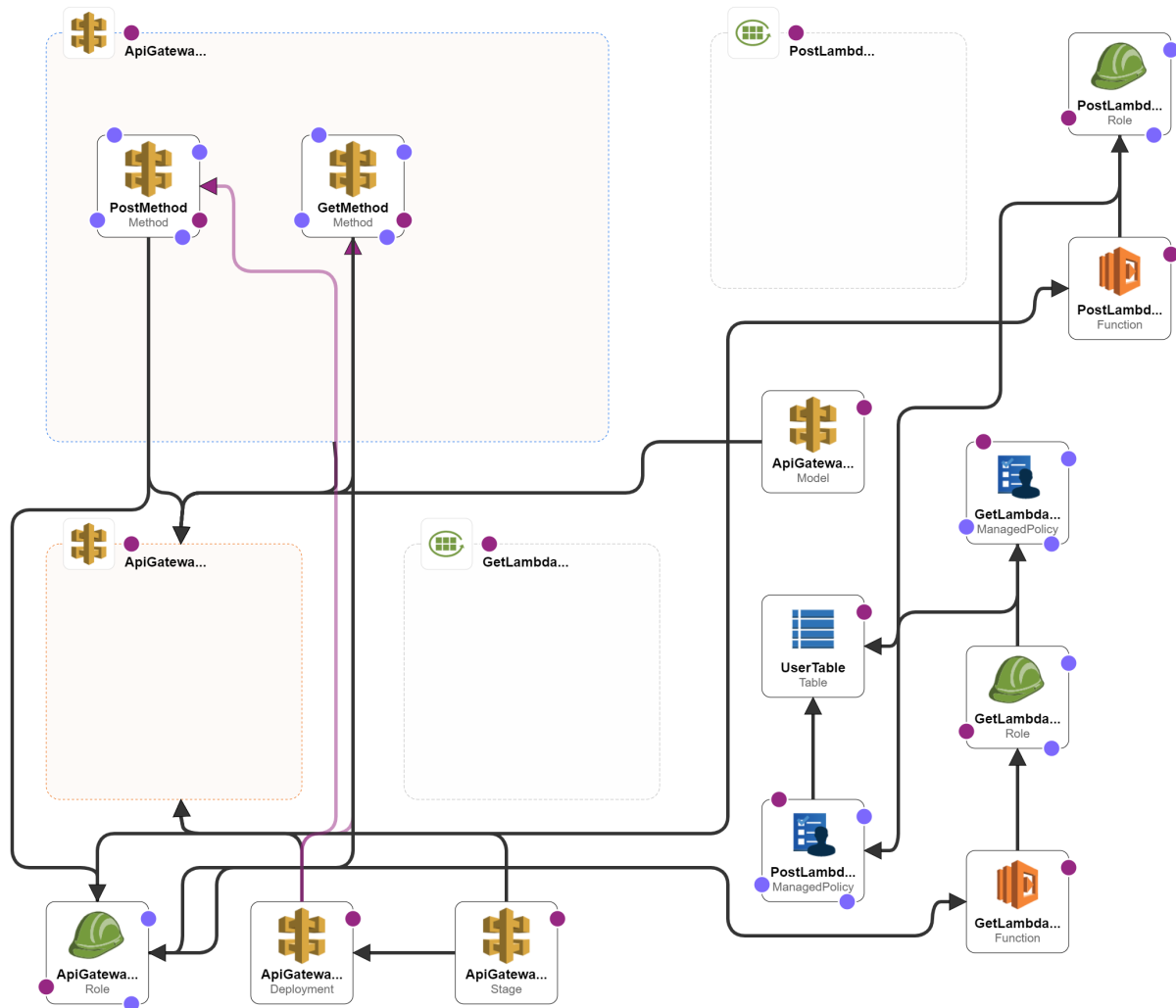


Figure 3.11: Architecture for deploying a REST API

and to follow all suggestions. Recognition Centre also manages connected tags or awards and allows you to track information history and generate reports.

In the architecture, the User Service is a vital microservice. This service handles user-related tasks including user registration, authentication, and profile maintenance. It stores user information such as personal information, preferences, and login credentials. To guarantee a consistent user experience, the User Service provides APIs for user registration, login, and

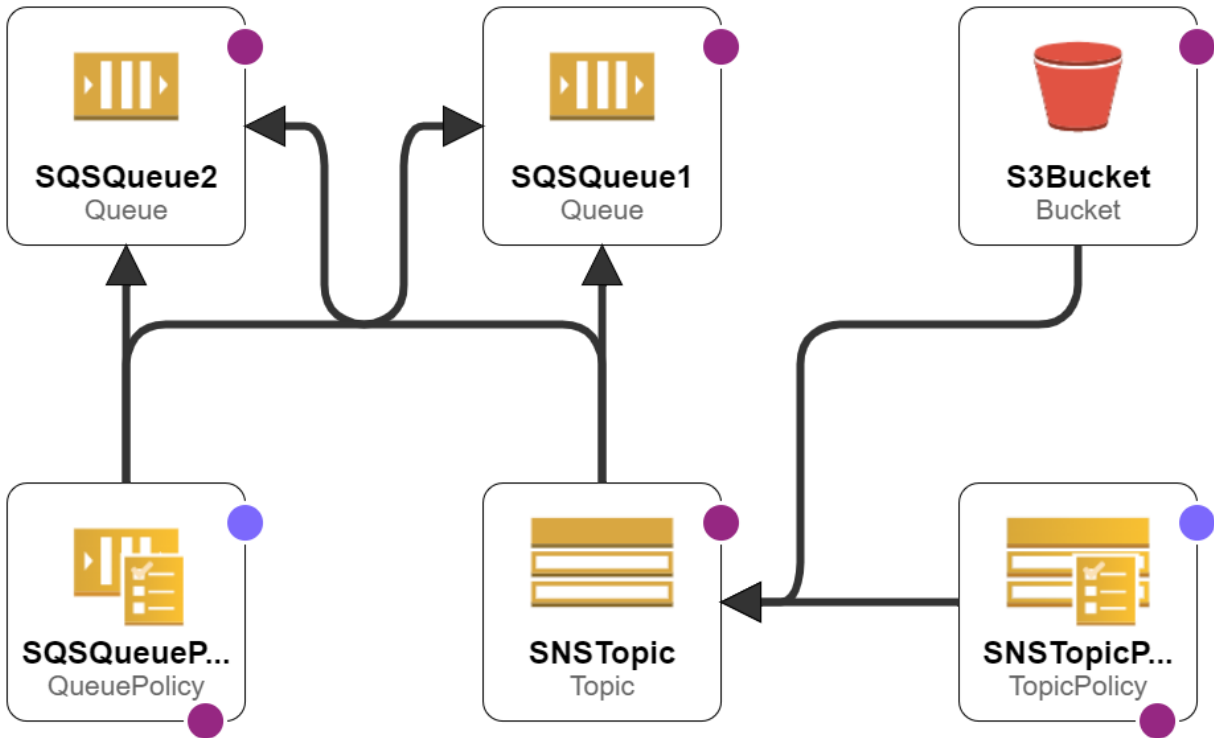


Figure 3.12: Architecture for deploying a notification system

profile modifications.

The Recognition Service is another important microservice in the concept. It is in charge of supervising the Kudos app’s recognition procedure. This service is in charge of producing, submitting, and obtaining instances of recognition. It allows users to recognise friends and coworkers and keeps track of all recognition incidents. The Recognition Service also keeps track of recognition badges or incentives and allows you to create reports based on your recognition history.

The Notification Service is critical for keeping people informed and engaged. It automates notification dissemination to users, ensuring that they get new recognitions, milestones, or system notifications on time.

Furthermore, the Analytics Service provides valuable insights by collecting and evaluating

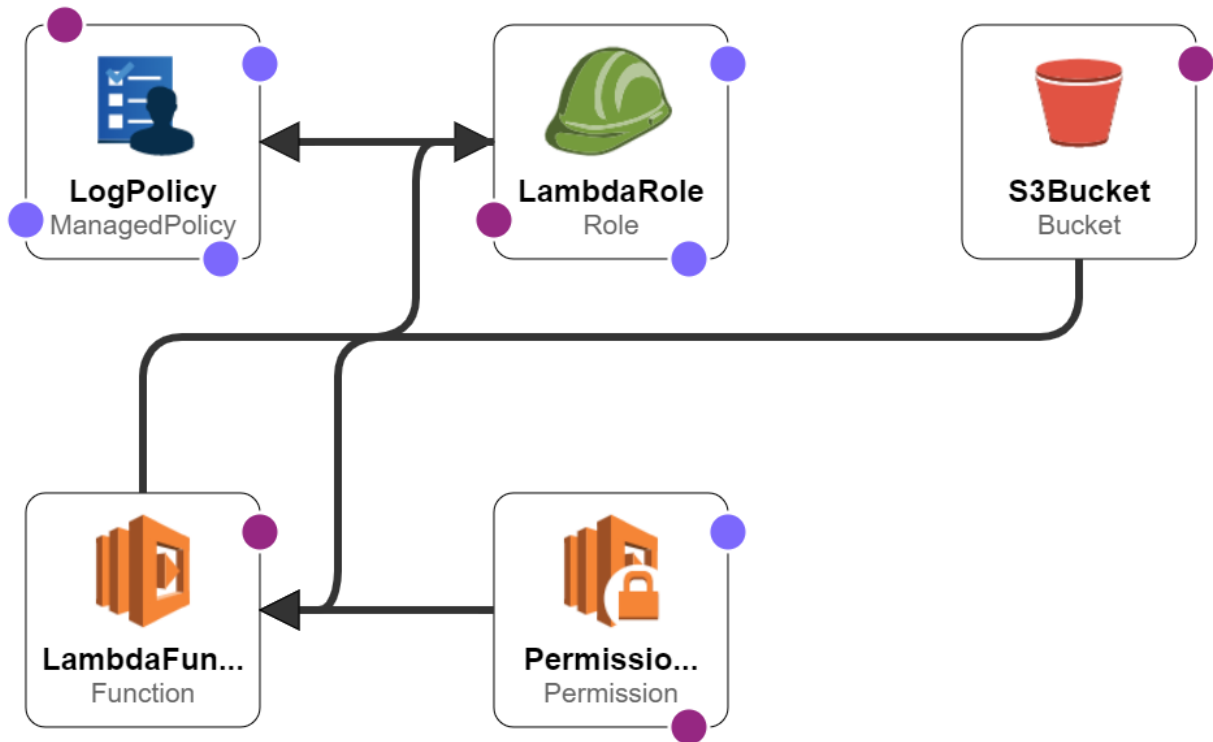


Figure 3.13: Architecture for deploying a Serverless lambda with S3

data related to employee appreciation. It captures and evaluates data on pattern recognition, user engagement, and performance metrics. This information may be used to generate detailed reports, display data trends, and identify areas for improvement. The Analytics Service helps businesses to make data-driven decisions, improve recognition programmes, and foster an appreciation culture.

The microservices design of the Kudos app provides several advantages. Individual services may be independently designed, deployed, and expanded, allowing for flexibility and resilience. The services can be developed using a variety of technologies or programming languages, depending on their specific requirements. The use of well-defined APIs ensures that services effortlessly communicate and interact with one another.

3.5 Security Measures

The Kudos App has security features to protect user data and provide a secure environment. Authentication and authorization, data encryption, safe development practises, vulnerability management, audit logs and monitoring, regulatory compliance, and periodic security upgrades are all part of these procedures.

Authentication and authorisation mechanisms are in place to confirm user identities and regulate application access. Robust protocols such as OAuth or JWT are used for secure authentication, and role-based access control (RBAC) is used to regulate user privileges.

Both at rest and in transit, the Kudos App encrypts critical data. Encryption methods such as SSL/TLS are used to secure data transmission, while database encryption techniques are used to protect stored data.

Secure development practises are followed, with an emphasis on code quality and adherence to best practises. Regular security audits, code reviews, and vulnerability scans help detect and repair potential issues.

Comprehensive audit logs capture user activity and system events, allowing anomalous conduct or illegal access attempts to be detected. IDPS (intrusion detection and prevention systems) are another option.

The Kudos App enforces data privacy laws such as the GDPR and the CCPA. The processing of user data considers privacy and security considerations.

To address new risks and vulnerabilities, the Kudos App is continuously updated with security upgrades, bug fixes, and enhancements.

These security measures work together to offer a secure environment for the Kudos App,

protecting user data and maintaining the system's confidentiality, integrity, and availability.

Chapter 4: Performance Analysis

4.1 Testing Plan

The Kudos App testing technique provides a comprehensive way for validating the quality, dependability, and functioning of the application. The plan includes a number of tests that are necessary for a thorough evaluation of the system.

Unit testing is performed to check that the Kudos App's separate components are valid and functioning. This includes testing frontend interfaces, backend APIs, and microservices in isolation. The goal is to find any defects or weaknesses inside each component and ensure that they work properly.

Integration testing guarantees that the Kudos App's multiple components and services successfully communicate and interact. This process includes integrating frontend and backend components, as well as testing linkages with other systems or APIs. The emphasis is on maintaining consistent communication and data across all application components.

End-to-end testing is performed to assess the overall functionality and performance of the Kudos App from the user's perspective. It entails mimicking real-world events and user interactions in order to assess the program's flow, user interfaces, and core functionality. This form of testing helps to identify any difficulties that may develop when numerous components interact in a realistic setting.

Security testing is an important part of the testing process. It comprises assessing the sensi-

tivity of the Kudos App to potential security threats and vulnerabilities. To detect and solve any security weaknesses or threats, penetration testing, vulnerability scanning, and code analysis are all employed.

Performance testing is performed to evaluate the Kudos App's scalability, responsiveness, and stability under varying load conditions. It comprises simulating significant user traffic and stress-testing the system to monitor performance, detect bottlenecks, and optimise resource use.

Usability testing evaluates the Kudos App's user experience and interface. It entails collecting customer input via questionnaires, interviews, and usability testing in order to evaluate the app's usability, intuitiveness, and overall user happiness.

Furthermore, following any modifications or upgrades, regression testing is carried out to guarantee that existing functionality is not jeopardised and previously discovered issues are fixed.

By implementing this comprehensive testing plan, the Kudos App can be thoroughly evaluated, ensuring its quality, reliability, security, performance, and usability.

4.2 Testing Strategy

The development process repeats this testing sub-process a number of times for the following phases.

- Unit Testing
- Linters check

The process of testing a unit of code (module or programme) after it has been coded is known as unit testing. Integration testing evaluates if the many programmes that compose a system interact as intended, fit together, and have correct interfaces. System testing ensures that the system meets the design specifications. Users do acceptance testing to verify whether the system produced meets the Software Requirements Specification. Testing is performed in a hierarchical manner to ensure that each component is right and that the assembly/combination of components is correct. Merely testing a whole system at the end would most likely throw up errors in components that would be very costly to trace and fix. We have performed both Unit Testing and System Testing to detect and fix errors. A brief description of both is given below.

4.3 Unit Testing

Unit testing in the context of the Kudos App includes testing individual units or components of the application in isolation. These units include functions, methods, classes, or modules that perform specialised tasks or provide specialised functionality. The goal of unit testing is to ensure that these units are correct and perform as expected.

Unit testing is essential for validating several Kudos App components, such as functions and methods. You may validate the operation of functions responsible for user authentication, recognition creation, notification sending, or data retrieval by writing unit tests and analysing the output or behaviour.

In this example, we are testing the `create_recognition` function of the `recognition_service` module in the Kudos App. The test case validates that the function correctly creates a recogni-

```

import unittest
from kudos_app import recognition_service

class TestRecognitionService(unittest.TestCase):

    def test_create_recognition(self):
        # Initialize test data
        sender = 'john.doe@example.com'
        receiver = 'jane.smith@example.com'
        message = 'Great job on the project!'
        category = 'Teamwork'

        # Call the function to create recognition
        recognition_service.create_recognition(sender, receiver, message, category)

        # TODO: Add assertions to verify the expected behavior

        # Example assertions
        self.assertEqual(recognition_service.get_sender(), sender)
        self.assertEqual(recognition_service.get_receiver(), receiver)
        self.assertEqual(recognition_service.get_message(), message)
        self.assertEqual(recognition_service.get_category(), category)
        self.assertIsNotNone(recognition_service.get_timestamp())

if __name__ == '__main__':
    unittest.main()

```

Figure 4.1: Unit test for creating recognition

tion instance with the provided sender, receiver, message, and category.

The `unittest.TestCase` class is used as the base class for the test case. The `test_create_recognition` method represents the specific test scenario. Inside the test method, we initialize test data and call the function to be tested. We then use assertions (such as `self.assertEqual`) to check if the actual output matches the expected behavior.

Unit testing also allows for the evaluation of edge cases and boundary conditions that may be difficult to recreate during integration or end-to-end testing. You can simulate wrong inputs, empty values, or unexpected events to test the app's functioning in a variety of circumstances.

Additionally, unit testing may focus on the app's error handling features. You may confirm

that the app appropriately manages and shows errors by creating tests that mimic incorrect scenarios or exceptions. This ensures that the software handles unexpected occurrences gracefully and provides suitable error messages or fallback behaviour.

By including unit testing into the Kudos App development process, you may find and resolve issues early on, improving the overall quality and reliability of the application. Individual unit tests check them, making troubleshooting and maintenance easier and ensuring that each component functions correctly in isolation.

Chapter 5: Conclusion

5.1 Conclusion

To summary, the Kudos App is an effective employee recognition tool that is meant to increase employee engagement, foster an appreciation culture, and drive organisational performance. The app has a user-friendly frontend interface created using Angular that provides users with a smooth and straightforward experience.

Through its integration with Microsoft Teams, the Kudos App leverages the capabilities of the Bot Framework to enable automated recognition and notifications, enhancing the efficiency of recognition processes and promoting timely and meaningful appreciation among employees.

The app's microservices architecture, built on a serverless framework, ensures scalability, flexibility, and cost-efficiency. Each microservice is responsible for specific functionalities, such as user management, recognition creation, and analytics, enabling modular development, deployment, and maintenance.

Security measures implemented in the Kudos App prioritize data protection and privacy. Robust authentication mechanisms, data encryption, and regular security audits are in place to safeguard sensitive information and ensure compliance with industry standards and regulations.

For consolidating and organizing data, the software serves as a centralized platform. Recog-

recognition activities must be managed effectively in order to initiate recognition program. Workers have convenient access to well-arranged resources.

Through a handy application known as Kudos, coworkers can effortlessly show appreciation to each other. Enabling communication between superiors and subordinates, the interface is user-friendly. Based on specific details, one can send personalized greetings and expressions of gratitude. Behaviours or accomplishments.

Comprehensive testing plans, including unit testing, integration testing, and performance testing, guarantee the reliability, functionality, and performance of the Kudos App. These tests cover various aspects, such as functions, classes, edge cases, error handling, and user experience, resulting in a robust and stable application.

By enabling peer-to-peer recognition, managerial recognition, and facilitating continuous improvement through analytics and insights, the Kudos App creates a culture of appreciation, boosts employee engagement, morale, and productivity, and fosters a positive work environment.

5.2 Future Scope and Enhancement

- **Gamification features:** Including gamification elements in software can assist increase employee engagement and motivation. Leaderboards, badges, and virtual rewards can help to make recognition more dynamic and fun, encouraging employees to actively participate and strive for success.
- **Integration with Other Collaboration Platforms:** While the app now interacts with Microsoft Teams, it has the potential to expand into other popular collaboration platforms.

Platforms such as Slack, Google Workspace, or project management software may be incorporated, allowing businesses to use the app's features inside their preferred communication and productivity settings.

- **Enhanced Analytics and Insights:** By enhancing the app's analytics capabilities, businesses may acquire deeper insights into identifying trends, patterns, and effects. Using advanced analytics and data visualisation techniques, the app may give complete statistics and metrics that aid firms in making informed decisions, identifying areas for improvement, and analysing the efficacy of their recognition campaigns.
- **Creating a customised mobile app for the Kudos App** can increase user accessibility and convenience. A mobile app would enable employees to express and receive praise while on the road, fostering an appreciation culture that extends beyond the workplace.
- **Integration with HR Systems:** Integrating the app with existing HR systems, such as performance management or employee engagement platforms, can streamline data exchange and provide a more holistic view of employee recognition efforts. This integration can help align recognition with broader HR initiatives and enable seamless data synchronization.
- **Social Sharing Features:** Incorporating social sharing features within the app can amplify the impact of recognition. Allowing users to share recognition moments on social media or internal communication channels can create a ripple effect of positivity, increasing visibility and reinforcing a culture of appreciation.

5.3 Limitations

The Kudos App, while offering a range of benefits, also has certain limitations that need to be considered:

Adoption and Engagement Challenges: One potential limitation is the challenge of encouraging widespread adoption and maintaining long-term engagement with the app. Some employees may be resistant to change or hesitant to embrace new technologies. Overcoming these challenges requires effective communication, training, and ongoing support to promote adoption and encourage active participation.

Integration Complexity: Integrating the Kudos App with existing systems and platforms within an organization can be complex. Compatibility issues, data synchronization, and ensuring seamless integration with various HR systems or collaboration tools may require additional resources and technical expertise.

Scalability: As the user base and recognition activities within an organization grow, the scalability of the Kudos App may become a consideration. Ensuring that the app can handle increased user load and maintain optimal performance requires careful planning and infrastructure scaling.

Customization Limitations: While the Kudos App provides a range of features and functionalities, there may be limitations on customization options. Organizations with specific requirements or unique recognition processes may find it challenging to tailor the app to their exact needs without significant modifications.

Data Privacy and Security: As with any digital platform, data privacy and security are critical considerations. Ensuring that user information, recognition data, and sensitive organiza-

tional data are protected from unauthorized access or breaches requires robust security measures, regular audits, and compliance with relevant data protection regulations.

It's important for organizations considering the implementation of the Kudos App to assess these limitations alongside the app's benefits and determine how they align with their specific needs and requirements.

References

- [1] “An overview of chatbot technology,” 2020.
- [2] J. Walke, *Reactjs*, 2013.
- [3] R. M. Stallman, “Emacs: The extensible, customizable, self-documenting display editor,” 1981.
- [4] E. Dolstra, *The purely functional software deployment model*. Utrecht University, 2006.