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Development of Automatic Employee Leave Microservice using Spring Cloud Gateway

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***Abstract*— Managing employee leave is a complex task that requires a comprehensive approach. The concept of designing and implementing an automatic leave service web application using Spring Cloud Gateway is one approach.The system for managing employee leave takes into account legal responsibilities, regular communication with employees, and secure handling of private data. The application includes an automated approval process for leave requests and automatically updates the leave balance of employees. The application also integrates with a database system to store and retrieve leave records. The application is developed using Spring Cloud Gateway, which is a popular Java-based framework that provides a simplified and flexible way to create web applications. Spring Cloud Gateway offers various features such as dependency injection, security, data access, web services, testing, and more. This application is a viable solution for automating the leave management process in an organization, and Spring Cloud Gateway is a suitable framework for developing web applications with high productivity and quality. The automated approval process for leave requests saves time for managers and ensures that leave requests are processed in a timely manner.**

Keywords—Spring Cloud Gateway, Web services, Micro services, Automation, Client-server systems

I. INTRODUCTION

Leave Microservice is a microservice for Human resource management. A microservice is a collection of small, independent services that are connected with each other to process for a large application. In management applications, creating independent microservices using Spring Cloud Gateway will be a easier approach to maintain and route incoming requests. Leave microservice is an automated software where employees apply for leave and are accepted or rejected within the duly reasons and based on organisation's leave policy. An approach which reduces the workload on managers.

One of the most time-consuming tasks for a manager is managing staff leaves of absence. These leaves must be processed on a regular basis, which necessitates closely monitoring employee leave histories. It is necessary to keep track of the employee's used leaves throughout a specific time period and the leaves that are still available.

As a result, it makes sense to transition to an automated leave management system.

- Simpler and faster
- Ease of accepting or rejecting requests
- Transparency and compliance with an organization's leave policy

Aspects of Spring Cloud Gateway

- Gateway: Powerful, yet simple way to route and manage network requests to applications. It utilizes a non-blocking, reactive design that can scale to handle many concurrent queries.
- API Gateway functions as a link between API clients and backend services. It performs the function of a reverse proxy, forwarding client requests to the relevant backend service and then relaying the result back to the client.
- Security: Extensive support for authentication and authorization. It protects against attacks like session fixation and clickjacking and integrates with the Servlet API.
- Discovery: Service Discovery is a crucial component of microservice architecture. Manually configuring each client or using conventions can be challenging and unreliable. Eureka, developed by Netflix, is a Service Discovery Server and Client. It can be set up to be highly

available and can share information about registered services with other servers.

II. CHALLENGES OF MANUAL LEAVE MANAGEMENT SYSTEMS

A. *Manual process*

Manually processing leave requests can be a time-consuming and inefficient process for an organization. Unplanned absences can disrupt workflow and cause missed targets and deadlines, resulting in financial losses. Additionally, failing to provide employees with their legally entitled paid leave can lead to dissatisfaction and potential legal issues in the future.

B. *Indistinct policies*

Unreliable leave policies can pose significant challenges for companies. Disruptions in productivity and missed deadlines can result in significant costs. Additionally, depriving employees of their legal rights to paid leave can create problems for a company.

C. *Lack of management*

Managers are unable to handle leave requests and approvals on time. Keeping track of accrued leaves can be dilatory. Managers can process a single request at a time, while having a few members with authority to verify and grant requests can take forever to accept or reject a leave request.Slower update of leave balance.

These challenges highlight the importance of having a well-defined leave policy and an efficient leave management system can help ensure fair and consistent treatment of employees, reduce confusion and misunderstandings, improve employee morale and productivity, and reduce the administrative burden on HR staff.

III. TRADITIONAL VS AUTOMATED APPROACH

TABLE I. COMPARISON BETWEEN TRADITION AND AUTOMATED METHOD IN LEAVE MANAGEMENT SYSTEM

Traditional approach	Automated approach
1. Either a staff or managers manage requests received	1. An application-based web service system undertakes all the requests
2. There is no transparency, and employees are not informed of minor policy changes	2. Transparency, ease of updating policies, and prompt employee notification
3. The procedure of accepting or rejecting requests is lengthy and time-consuming	3. A quicker and easier way to request leave that also provides a real-time status update
4. Employee communication is minimal	4. Employees receive periodic communication
5. Admins or authorized members must update the leave balance	5. Auto-update Leave balance
6. Basic level security system	6. Secured system to prevent unauthorized access to private and sensitive data
7. Not sufficiently adaptable for authorized personnel to change	7. User-friendly, simple to use, and flexible enough for authorized staff to update and modify

IV. METHODOLOGY

In every huge organization, managing each individual's leave requests manually is inconsistent and can create issues. An automated system eliminates those errors. An effective leave management system boosts employee satisfaction, provides transparency, and prevents unanticipated incidents. It also assists employers in reducing unexpected or excessive absence.

The use of an automated leave management system eliminates all manual effort and saves HR a substantial amount of time by gathering data on employee absences and perhaps producing tailored, analytical reports. Designed to improve the administration of absences, PTO, and sick leave. Everything complies with the strict guidelines that are applicable to the entire company.

With adequate policies in place for every leave Establishing a leave policy will aid in dealing with various leave scenarios. Additionally, you can adjust the leave authorisation workflow for each employee or apply the maximum amount, when the leave policy is updated.

A robust automated leave management system may help employees plan holidays with certainty and managers manage work based on staff availability.

When the employee submits the request, the records are immediately updated. The system either approves or denies the leave request in accordance with the policies. The leave balance is promptly updated after approval. The request for a leave of absence is then reported to the manager. It is both easy to use and successful.

A. *Description of Actors and their Use case*

TABLE II. ACTORS, USE CASES AND THEIR DESCRIPTION

Actor	Use case	Description
Employee	Apply leave	Employees will be able to apply leave request
Employee	Check leave balance	Employees will be able to view the remaining leave balance
Employee	Leave history	Employees will be able to view past leave history
HR	View employee leave details	HR will be able to view leave details of an employee
HR	Update policies	HR will be able to update policies

HR	Update leave balance based on updated policies	HR will be able to update level balance according to renewed policies
HR	Notified when leave is accepted	HR will be notified when employee leave is accepted
Admin	Manage user role	Admins will be able to manage user roles
Admin	Maintain/update database and server	Admins will be able to maintain/update database and server

B. ER diagram and Flowchart

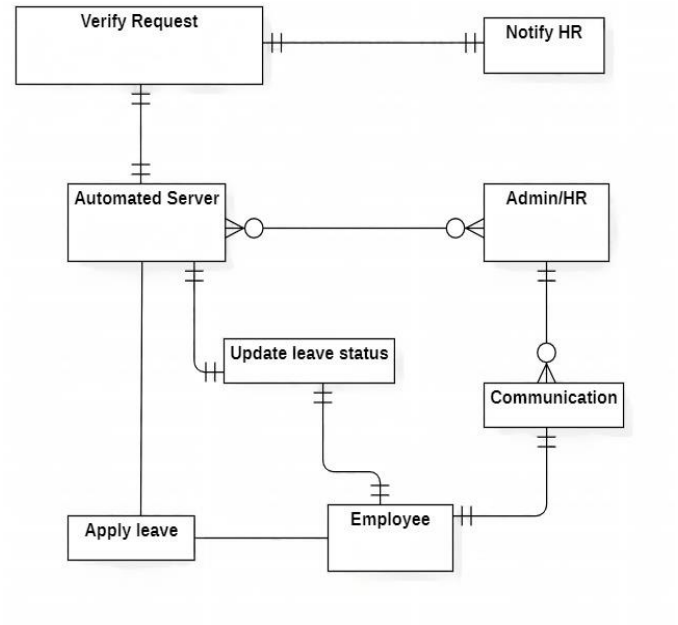

Fig. 1. ER diagram

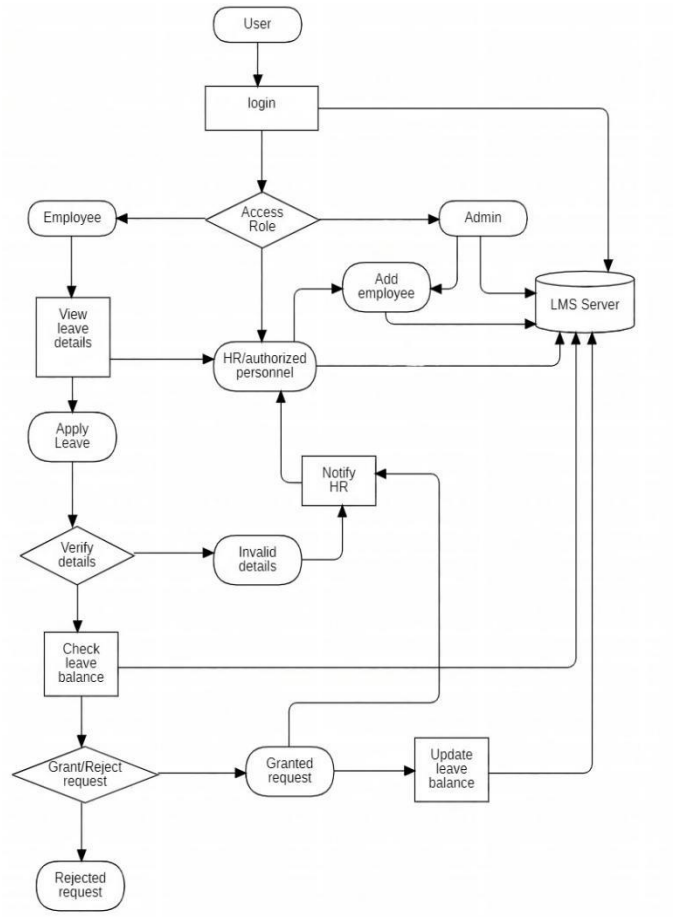

Fig. 2. Flowchart of automated Leave Management System

C. System design

The system design phase of information system development is the most difficult. It is a very creative procedure that calls for the system analyst to have extensive knowledge and imagination. System design is primarily concerned with how to use equipment, job practices, and activities in a coordinated manner to accomplish organizational goals. It can be aided by doing the following:

- Existence of a well-defined problem. a visual explanation of the current system.
- The area that contains general baseline knowledge.
- A thorough understanding of the existing system and the development of a set of requirements.

D. Spring microservices

- The new age technology of creating small, independent mechanisms is an approach to programming an architecture into pieces of small logical applications. Each microservice executes its own procedure and

communicates using simple mechanism. These services were separately created using deployment machinery that is totally automated and are based on business capabilities.

- Leave management microservice is part of a large application Human Resource management system. Building an individual, manageable microservice is easy to maintain, eradicates faulty system. Any single module error, won't affect the large application, it runs independent of the available services. The main purpose is to focus on a single responsibility, at a time. They can be updated and designed independently without causing an issue for other services.
- Without Spring Cloud, a microservice architecture would not be complete. Spring Cloud makes administration easier and increases fault tolerance. Spring Cloud assists with service discovery,circuit breaker, distributed tracing, load balancing, and monitoring. It can even serve as an API gateway.

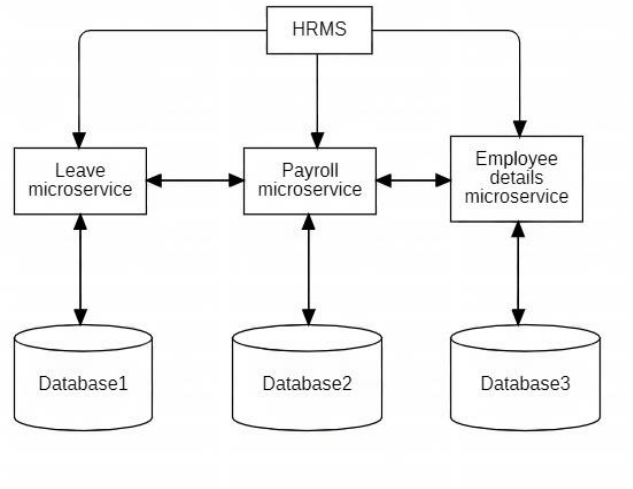

Fig. 3. Microservice architecture

E. *Spring Gateway*

With its cross-cutting concerns including security, monitoring/metrics, and robustness, Spring Cloud Gateway strives to provide an easy-to-use yet effective approach to route to APIs. In order to resolve the spring milestone and snapshot repositories, the spring Maven profile must be activated; failing to do so may result in build errors. The Spring Cloud Gateway employs routes to route requests to downstream services. All requests are forwarded to HTTPBin by it. Routes can be set up in a variety of ways.

F. *Spring Eureka server*

An application called Eureka naming server keeps data on all client service applications. The Eureka naming server receives registration requests from each microservice. The client services are registered with their IP addresses and port numbers by the naming server. It also goes by the name Discovery Server. The Spring Cloud package includes the Eureka naming server. It operates on port 8761 by default. Additionally, it includes a Java-based client component called the Eureka client that makes using the service much simpler.

G. *Service discovery*

One of the foundational principles of a microservice-based architecture is service discovery. It might be challenging and fragile to manually setup every client or to follow a set of rules. Eureka is the Netflix Service Discovery Server and Client. The server may be deployed, configured, and registered with other services. Microservices are authenticated and registered with the Eureka Server.

H. *About the project*

The automated Leave management service enables users to access the secure network, and apply for request or view leave details based on their authorization. Once a user logs in to the web service, it should work as follows:

- Admins and HR will have access to add new employees.
- HR will be able to view very employees leave details.
- Employees will have a navigation menu to select apply leave or view leave balance
- When employees apply for a leave request, they need to select options available based on their policies.
- For example, first employees will be asked whether they want to apply for paid or unpaid leave.
- Then the service shows available leave balance, if an employee selects for paid leave. Next, they need to select the reasons listed, either illness or personal leave differing to policies and organization requirements. Employees will have an option to state a reason for applying leave request.
- They need to select number of days to take leave.
- If all the options are satisfied and the employee has enough leave balance for the number of days selected, they will be granted their leave.
- If employees don't have enough leave balance for requested number of days, the request will be rejected.
- If an employee selects unpaid leave, most of the options will be the same, except for displaying available leave balance. A Leave request will be granted.
- HR will be notified after a leave request is granted and will have authority to reject a leave if any given reason listed are unclear or if any important events in the organisation are held during the leave time period, except for illness request.
- Employees and HR will be able to view previous leave requests applied by an employee.

- Rejected leave requests will also be notified to HR. The HR can view all the requests applied.
- Admins can view every employees activity log, when an employee logs in to web application.

I. Database

Independent microservice can have their individual database, but for HRMS single database needs to be connected to each and available microservices in the system. Database can be maintained on any DBMS software like My SQL , PostgreSQL. Once a database is established, microservice needs to be connected to database.

Database tables of HR Admin and employee

TABLE III. HR ADMIN TABLE

Column name	Data type	Description	Remark
User name	Varchar2	Login name	Primary key
Password	Varchar2	Login password	

TABLE IV. EMPLOYEE TABLE

Column name	Data type	Description	Remark
Emp ID	Int	Employee ID	Primary key
Emp password	Varchar2	Employee password	
DOB	Varchar2	Date of birth	
Email	Varchar2	Email ID of employee	
Phone number	Int	Phone number of employee	
Address	Varchar2	Employee address	
Qualification	Varcahr2	Highest qualification	
Desgination	Varchar2	Employee role	
Department	Int	Department	
		number	

CONCLUSION

Modern technology on creating independent microservices, have significant impact on huge web based management application like Human Resource management system. The automatic leave service web application using Spring Cloud Gateway is a comprehensive solution for managing employee leave in an organization. An automated leave management system offers numerous benefits for both employees and managers. It eliminates manual effort, saves time for HR by gathering data on employee absences and improves the administration of absences, PTO, and sick leave. This application is a viable solution for automating the leave management process in an organization.

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