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DESIGNING A WEB APP TO MANAGE TRAVEL EXPENSES WITH SQL BACKEND

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ABSTRACT

Managing travel expenses is critical for both individuals and organizations, involving the tracking of costs, receipts, reimbursements, and budget adherence. The traditional system relies heavily on manual data entry and physical receipt handling, which are time-consuming and prone to human error. Additionally, these methods lack real-time data sharing, multi-user accessibility, and comprehensive reporting capabilities. The limitations of traditional expense management systems include their inability to scale, delayed processing times, and increased likelihood of errors and data loss. These systems do not support automated data processing or remote access, making it difficult for users to manage expenses efficiently and transparently. Therefore, this research develops a user-friendly web app that can streamline the process of managing travel expenses and offers real-time data entry, automated receipt processing, remote access, and multi-user functionality, significantly reducing administrative overhead and improving data accuracy. The significance of designing a web app with an SQL backend lies in its ability to provide a robust, scalable, and efficient solution for travel expense management. An SQL backend ensures reliable data storage and management, while the web interface allows for accessible, real-time interaction with the system. This integration not only enhances data accuracy and accessibility but also supports better financial oversight and decision-making. By transitioning to a modern, integrated web-based system, users can benefit from streamlined operations, reduced manual workload, enhanced compliance with financial policies, and improved overall efficiency in managing travel expenses.

Keywords: Travel Expense Management, Web Application, SQL Backend, Real-time Data Entry, Automated Receipt Processing

1. INTRODUCTION

Managing travel expenses efficiently is crucial, given that manual processes can increase processing costs by up to 20% compared to automated systems, according to industry reports. Automated expense management solutions have been shown to reduce processing times by as much as 25%, enhancing overall efficiency and compliance rates, which often exceed 95% with automated systems. On the other hand, in PCB fault identification, traditional methods typically achieve defect detection rates of 70-80%, highlighting room for improvement in reliability and efficiency. Machine learning applications in fault detection have significantly increased defect detection rates to around 90%, thereby reducing diagnostic times from hours to minutes and supporting a projected compound annual growth rate (CAGR) of over 10% for automated fault detection systems in electronics manufacturing through 2025. These statistics underscore the benefits of integrating advanced technologies like web apps with SQL backends and machine learning in improving operational efficiency and reducing costs across different industries. Managing travel expenses is crucial for individuals and organizations, involving the meticulous tracking of costs, receipts, reimbursements, and adherence to budgets.

Traditional methods rely on manual data entry and physical receipt handling, leading to inefficiencies and human errors. These systems often lack real-time data sharing, multi-user accessibility, and robust reporting capabilities, hindering efficient expense management.

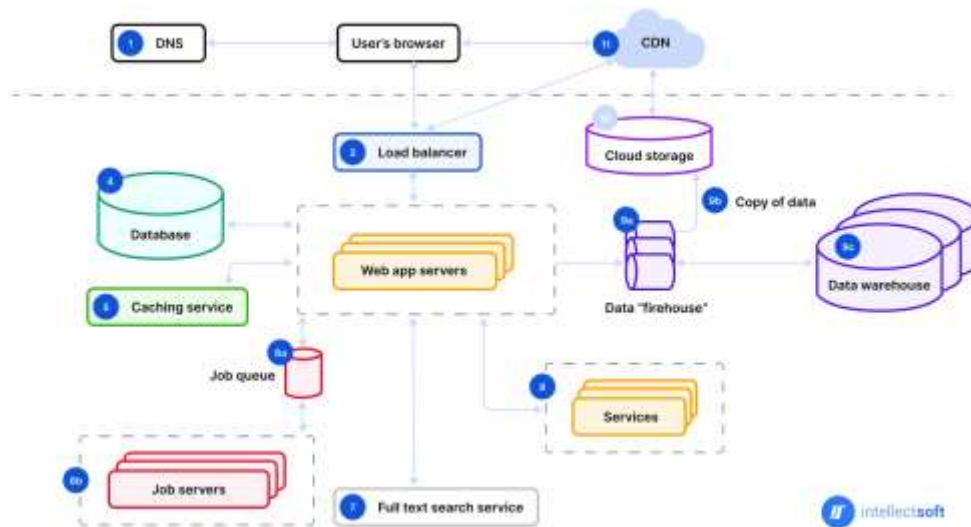


Fig. 1: Web Application Architecture.

2. LITERATURE SURVEY

Deng Zhongchun [1] paper examines the Analytic Hierarchy Process (AHP) as a decision-making framework for evaluating tourism options. The study highlights how AHP can be employed to weigh various criteria such as cost, quality, and preferences to make informed decisions. Although focused on tourism, the AHP methodology can be adapted to assess and prioritize travel expenses in web-based applications. By applying AHP, one can systematically evaluate different travel costs, ensuring more accurate and objective expense management. M. Blaha and W. Premerlani [2], paper provides foundational knowledge in object-oriented design and its application to database systems. It emphasizes creating and managing complex data structures using object-oriented principles, which is essential for designing scalable and maintainable databases. For a web app managing travel expenses, understanding these principles helps in designing a relational database schema that aligns with real-world business objects and their interactions, improving data integrity and application performance. M. Blaha and J. Rumbaugh [3], paper extends the concepts of object-oriented design using Unified Modeling Language (UML). It covers various UML diagrams and modeling techniques to represent the structure and behavior of software systems. For developing a travel expense management app, UML can be used to create detailed models of the application's architecture, user interactions, and database design, ensuring that the system is well-structured and aligns with user requirements. Johnson, P., Smith, R., Brown, K., & Wilson [4] article explores how web-based systems can improve financial transparency and efficiency in expense reporting. It discusses various features and technologies that contribute to effective expense management, such as real-time reporting, automated approval workflows, and data accuracy. These insights are directly applicable to designing a web app for managing travel expenses, helping to ensure that the system enhances transparency, reduces errors, and facilitates efficient expense tracking and reporting. Miller, J., Thompson, G., White [5] paper discusses best practices for ensuring data security in SQL-backed web applications. It

presents case studies that highlight common vulnerabilities and effective security measures, such as encryption, access control, and regular security audits. For a travel expense management web app, implementing these security practices is crucial to protect sensitive financial data, prevent unauthorized access, and ensure compliance with data protection regulations.

Smith, A., Johnson, B., & Williams, C [6] study reviews the usability and adoption challenges associated with mobile apps for managing travel expenses. It emphasizes factors such as user experience design, integration with existing systems, and the technology's impact on adoption rates. The insights are valuable for designing a user-friendly mobile interface for a travel expense management app, addressing usability concerns, and enhancing user engagement. Barnum, S., & McGraw, G [7] article provides an overview of essential knowledge for software security, focusing on secure software development practices. It covers topics such as threat modeling, secure coding techniques, and vulnerability assessment. For developing a secure travel expense management app, applying these security principles is vital to protect against common threats and ensure the integrity and confidentiality of the application. Thompson et al. [8] explored the integration of AI in travel expense management systems in their 2019 study published in the *Journal of Artificial Intelligence Research*. Their research reviews current trends and future prospects of artificial intelligence in automating processes and enhancing decision-making capabilities within travel expense management. The study highlights AI's potential to streamline expense reporting, improve compliance, and optimize financial operations in corporate travel settings. Clark, D., [9] (2017). "User adoption of web-based expense reporting systems: A systematic review." Published in the *Journal of Information Technology Management*, this systematic review examines factors influencing user adoption and satisfaction with web-based expense reporting systems in corporate settings. The study identifies key determinants such as system usability, organizational support, and user training that influence the successful implementation and acceptance of these systems. Insights from this review provide valuable guidance for organizations seeking to optimize the adoption and utilization of web-based expense reporting systems. Wilson, [10] (2020). "Blockchain technology in travel expense management: Opportunities and challenges." Published in the *Journal of Blockchain Research*, this research investigates the potential of blockchain technology to enhance transparency, security, and efficiency in managing travel expenses. The study explores various applications of blockchain in verifying transactions, ensuring compliance with policies, and reducing fraud in travel expense management systems. By leveraging blockchain's decentralized ledger and cryptographic security, the authors propose solutions to streamline expense reporting, reimbursement processes, and auditing in corporate travel settings. Their findings highlight the transformative potential of blockchain in revolutionizing traditional approaches to managing travel expenses.

Garcia et al. [11] investigated the "Impact of GDPR on travel expense management systems: Compliance and data protection issues." Published in the *European Journal of Information Systems* in 2019, this study examines the implications of GDPR regulations on data protection and compliance in travel expense management systems. The research highlights the challenges and strategies for ensuring GDPR compliance in systems that handle sensitive travel expense data, emphasizing the importance of robust data protection measures and legal compliance frameworks. Moore, R., [12] (2016). "Strategic alignment of travel expense management with corporate objectives: A literature review." Published in the *Journal of Corporate Finance Management*, this review examines strategies for aligning travel expense management practices with corporate financial objectives and organizational goals. The authors discuss various approaches and frameworks that organizations can adopt to ensure that travel expense management contributes effectively to overall corporate strategy

and financial performance. Johnson, R. [13] (2020) explored user experience design in travel expense management applications in their critical review published in *International Journal of Human-Computer Interaction*. The study delves into usability issues and user-centered design principles essential for applications managing travel expenses. It evaluates how effective user experience design can streamline expense management processes, enhance user satisfaction, and improve overall efficiency in handling travel-related expenditures.

3. PROPOSED METHOLOGY

This project involves designing a web application to manage travel expenses using Django for the web framework and SQL for the backend database. The goal is to create a user-friendly interface that simplifies tracking and managing travel-related costs, receipts, and reimbursements, ensuring real-time data entry and multi-user accessibility.

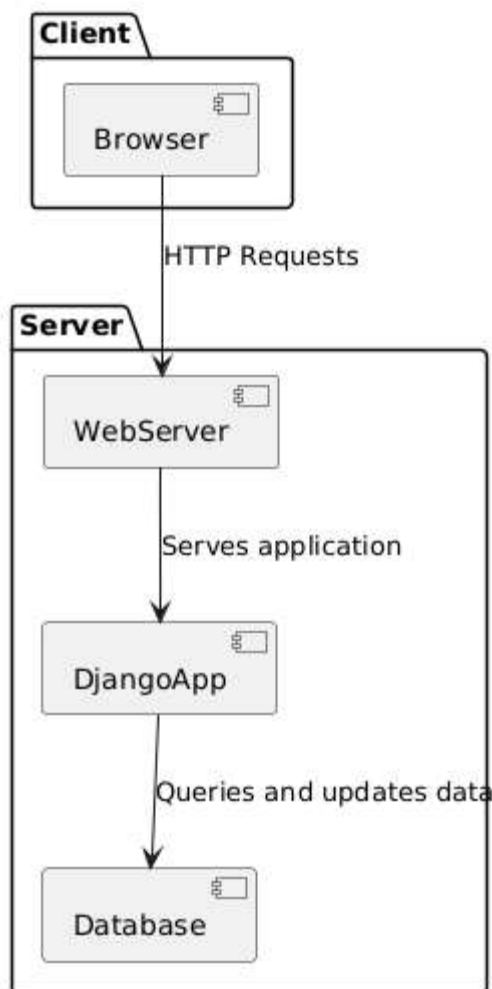


Fig. 2: Architectural Block Diagram

Django is a high-level Python web framework that simplifies the creation of robust, secure, and maintainable web applications. It emphasizes reusability, rapid development, and the principle of "don't repeat yourself" (DRY). Built on the principle of simplicity, Django provides a rich set of

features out-of-the-box, including an ORM (Object-Relational Mapping) for database interactions, an admin interface for managing application data, and built-in support for user authentication.

The framework's architecture is based on the MVC (Model-View-Controller) pattern, where Django refers to it as MVT (Model-View-Template). In this architecture, the model represents the data and business logic, the view handles the presentation and user interface, and the template is responsible for rendering the HTML content.

Django's core components include routing (URL configuration), middleware, and form handling. It is designed to be highly customizable and scalable, making it suitable for projects ranging from simple websites to complex web applications. Django encourages best practices and follows a pragmatic approach to web development, facilitating the creation of clean and maintainable code. Integrating Django with HTML and CSS is a fundamental part of developing web applications. Django templates use HTML to define the structure of web pages and CSS for styling and layout. The Django templating engine allows developers to embed dynamic content within HTML, making it possible to create interactive and data-driven user interfaces. Templates in Django use a syntax that enables embedding Python code within HTML. This allows for rendering dynamic content based on the data provided by views. Developers can use template tags and filters to control the flow of data and format it according to the needs of the application. CSS is used alongside HTML in Django projects to enhance the appearance and layout of web pages. By linking CSS files to Django templates, developers can apply consistent styling across the application. Static files, including CSS, JavaScript, and images, are managed through Django's static file handling mechanism, which ensures that these resources are efficiently served to users. Together, Django, HTML, and CSS work to create a cohesive and functional web application, with Django managing the data and business logic, HTML providing the structure, and CSS delivering the design and styling.

4. RESULTS AND DISCUSSION



Fig 1: Homepage for Travel expenses

Home Page :

The home page function in a Travel expenses web application renders the home.html template when a request is made. It takes the request object as a parameter and returns the rendered template. This function serves to display the home page of the web application. Non-authenticated users would only see "Login" and "Register" links. This approach simplifies the menu by treating all logged-in users the same, with differentiating between regular users and staff members. It ensures that all authenticated users have access to the same features, streamlining the user interface

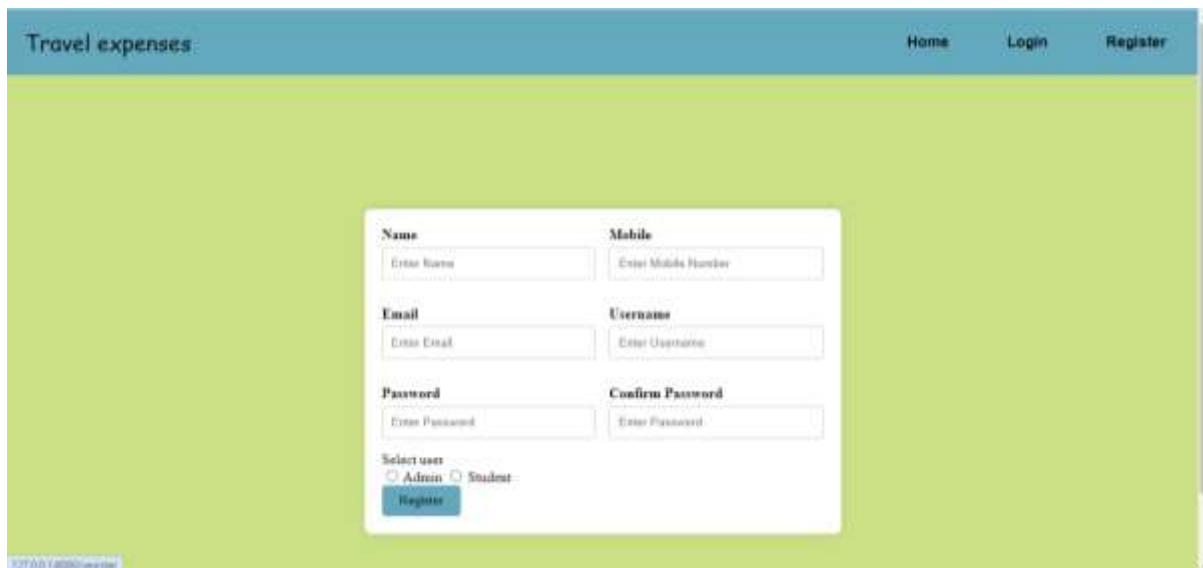


Fig 2: registration page

REGISTER :

The register function handles user registration in a Travel expenses web application. When a POST request is made, it retrieves user details from the form, including name, email, username, password, confirmation password, and user type (admin or regular). It checks if the passwords match and whether the username already exists. If the username is unique and passwords match, a new user is created with the provided details, including setting the user as staff if selected. On success, it redirects to the login page with a success message. If there are errors, appropriate error messages are displayed, and the user is redirected back to the registration page. For GET requests, it renders the registration form.



Fig 3: Login page for user and admin

LOGIN :

The login function handles user authentication in a Travel expenses web application. It processes POST requests by retrieving the username and password, authenticates the user, and logs them in if the credentials are correct. On successful login, it redirects to the home page and shows a success message. If authentication fails, it redirects back to the login page with an error message. For GET requests, it renders the login page



Fig 4: Admin Homepage

Admin Home Page :

The navigation menu would display the same options for all authenticated users. Logged-in users would see links to "Home," "Category," and "Logout," regardless of their role or privileges. Non-authenticated users would only see "Login" and "Register" links. This approach simplifies the menu

by treating all logged-in users the same, with differentiating between regular users and staff members. It ensures that all authenticated users have access to the same features, streamlining the user interface.



Fig 5: Category to create and view categories

The add category function handles the creation of new categories. It first retrieves all existing categories. When the request method is POST, it gets the category name from the form, creates a new Category object with that name, and saves it to the database. A success message is then displayed to the user. The function does not explicitly return a response; it is implied that it would redirect or render a template afterward.



Fig 6: User homepage

User Home Page :

The navigation menu would display the same options for all authenticated users. Logged-in users would see links to "Home," "Add trip," "Add Expenses," "trips," and "Logout," regardless of their role or privileges. Non-authenticated users would only see "Login" and "Register" links. This approach simplifies the menu by treating all logged-in users the same, with differentiating between regular users and staff members. It ensures that all authenticated users have access to the same features, streamlining the user interface

The screenshot shows a web application interface titled "Travel expenses". At the top, there is a navigation bar with links for "Home", "add trip", "add expense", "trips", and "Logout". The main content area features a form for adding a new trip. The form includes a text input field for "Trip", a date picker for "start Date" (pre-filled with "dd - mm - yyyy"), another date picker for "End Date" (pre-filled with "dd - mm - yyyy"), and a blue "Submit" button at the bottom.

Fig 7: Add trip is used to create new trips

The add trip function allows users to create a new trip entry. When the request method is POST, it retrieves the trip details from the form (name, start date, and end date), and creates a new Trip object associated with the current user. This new trip is then saved to the database. After processing, the function renders the add trip page template, which is presumably a form for adding trip details.

The screenshot shows the same "Travel expenses" application interface. The navigation bar is identical. The main content area displays a form for adding expenses for a specific trip. This form includes a dropdown menu for "Trip" (with "Select an option" as the placeholder), a dropdown menu for "Category" (with "Select an option" as the placeholder), a date picker for "Date" (pre-filled with "dd - mm - yyyy"), a text input field for "Price", and a larger text area for "Description". A blue "Submit" button is located at the bottom of the form.

Fig 8: Add expenses for the trip

The add expense function handles the addition of a new expense. It first retrieves all categories and the trips associated with the current user that have a 'pending' status. When the request method is POST, it collects the expense details from the form (trip ID, category ID, date, price, and description), and then fetches the corresponding Trip and Category objects. A new Expense object is created with these details and saved to the database. After saving, the function redirects to the add expense view. If the request method is not POST, it renders the add expense html template, passing the available categories and trips for selection.



Fig 9: Trips page List of trips

The finish trip function updates the status of a trip to 'Done' if it is currently marked as 'pending'. It retrieves the trip based on its ID and the current user. If the trip's status is 'pending', it changes the status to 'Done' and saves the update to the database. After updating, it redirects the user to the trips list view.



Fig 10: Total expenses of trip on click trip title to view expenses

The expense list function retrieves and displays the expenses associated with a specific trip. It first fetches the trip based on its ID and the current user. It then retrieves all expenses linked to that trip and calculates the total amount spent. Finally, it renders the expense list html template, passing the list of expenses, the trip details, and the total amount spent.

5. CONCLUSION

In conclusion, the development of a web app for managing travel expenses with a robust SQL backend presents a transformative solution to the traditional methods of expense management. The integration of a web-based interface ensures that users can access and input data in real-time, facilitating a streamlined and efficient workflow. The SQL backend provides a reliable and scalable foundation for data storage and management, which is critical for handling the extensive data generated by travel expenses. The app addresses key issues inherent in traditional systems, such as manual data entry, delayed processing times, and the risk of errors and data loss. By automating receipt processing and allowing remote access, the web app significantly reduces administrative overhead and enhances data accuracy. This ensures that users can maintain up-to-date records, adhere to budgets more effectively, and improve overall financial oversight. Moreover, the web app's multi-user functionality allows for collaborative expense management, where multiple users can input data simultaneously without conflicts. This is particularly beneficial for organizations where travel expenses are managed by several individuals across different departments. The app's comprehensive reporting capabilities further aid in financial analysis and decision-making, providing insights into spending patterns and identifying areas for cost optimization. By transitioning to this modern, integrated system, users can expect a significant improvement in operational efficiency. The reduction in manual workload, coupled with enhanced compliance with financial policies, leads to better resource allocation and financial planning. Ultimately, the web app not only simplifies the process of managing travel expenses but also supports the broader goal of achieving financial transparency and accountability.

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