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Research Article

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Web-based system for managing transportation services

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Abstract This paper presents the design and implementation of a web-based application for managing transportation services, such as booking, tracking, and billing. The application is developed using Dot Net and Angular frameworks, and follows the principles of service-oriented architecture and microservices. The paper discusses the main features and functionalities of the application, as well as the challenges and benefits of using Dot Net and Angular for web development. The paper also evaluates the performance and usability of the application, and provides some recommendations for future work.

Keywords Web-based system, web-based application, managing transportation services,

Introduction

Transportation services are essential for many businesses and individuals, who need to move goods or people from one place to another. However, managing transportation services can be complex and time-consuming, especially when dealing with multiple providers, vehicles, routes, and customers. Therefore, there is a need for a system that can automate and simplify the processes of booking, tracking, and billing transportation services, and provide a user-friendly interface for both service providers and customers.

One way to develop such a system is to use web-based technologies, which offer many advantages, such as accessibility, scalability, interoperability, and security. Web-based applications can be accessed from any device and location, as long as there is an internet connection. They can also handle large amounts of data and users, and integrate with other systems and services through web APIs. Moreover, web-based applications can provide a secure and reliable environment for data storage and transmission, by using encryption and authentication mechanisms.

However, web development also poses some challenges, such as complexity, diversity, and dynamism. Web applications often involve multiple layers and components, such as front-end, back-end, database, and middleware, which require different skills and tools to develop and maintain. Web applications also have to deal with a variety of browsers, devices, and platforms, which may have different features and capabilities. Furthermore, web applications have to cope with the changing requirements and expectations of users and stakeholders, who demand high performance, functionality, and usability.

Therefore, web developers need to choose the appropriate frameworks and technologies that can help them overcome these challenges and deliver high-quality web applications. In this paper, we present a case study of a web-based application for managing transportation services, which is developed using Dot Net and Angular frameworks. Dot Net is a software framework developed by Microsoft, which supports multiple programming languages, such as C#, VB.NET, and F#. Dot Net provides a common platform and a set of libraries and tools for developing web, desktop, mobile, and cloud applications. Angular is a front-end web framework developed by Google, which uses TypeScript, a superset of JavaScript, as the main programming language. Angular enables the creation of dynamic and interactive web pages, by using components, directives, services, and modules.

The paper is organized as follows. Section II describes the design and implementation of the transportation application, and explains the main features and functionalities of the system. Section III discusses the challenges and benefits of using Dot Net and Angular for web development, and compares them with other frameworks and technologies. Section IV evaluates the performance and usability of the transportation application, and presents some feedback from the users and stakeholders. Section V concludes the paper and provides some recommendations for future work.

Design and Implementation

The transportation application is a web-based system that allows users to book, track, and bill transportation services, such as taxi, bus, train, or plane. The system consists of two main components: the front-end and the back-end. The front-end is the user interface of the system, which is developed using Angular. The back-end is the business logic and data access layer of the system, which is developed using Dot Net. The system also uses a SQL Server database to store and retrieve the data, and a RabbitMQ message broker to communicate between the front-end and the back-end. Figure 1 shows the architecture of the system.

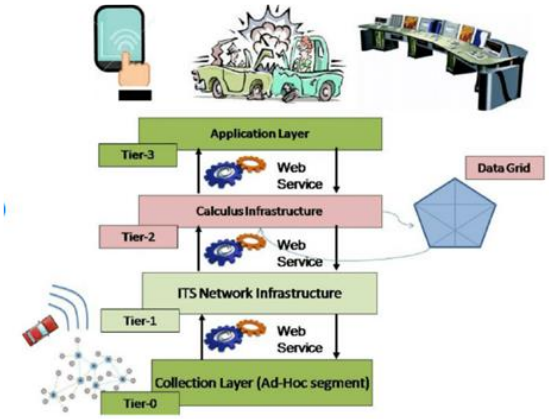

Figure 1: Architecture of the transportation application

The front-end of the system is composed of several Angular components, which are reusable and modular pieces of code that define the layout and behavior of the web pages. The components use HTML templates, CSS styles, and TypeScript classes to render the content and handle the user interactions. The components also use Angular directives, which are attributes that modify the appearance or behavior of the HTML elements, and Angular services, which are classes that provide common functionality and data to the components. The components are organized into Angular modules, which are collections of related components, directives, services, and other resources. The system has four main modules: the home module, the booking module, the tracking module, and the billing module. Each module has its own routing configuration, which defines the navigation and URL paths of the web pages. Figure 2 shows the structure of the front-end.

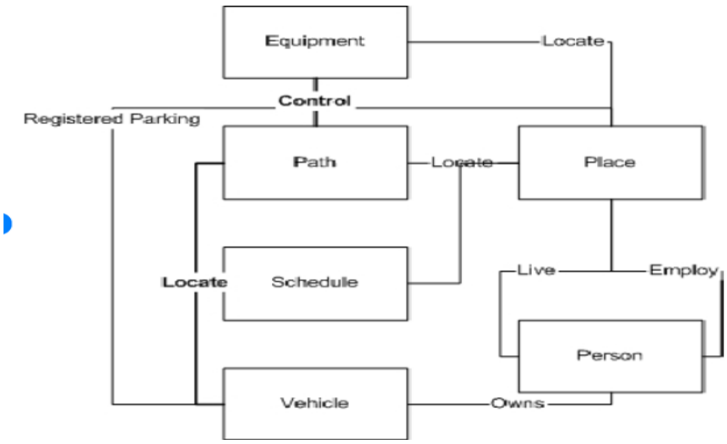

Figure 2: Structure of the front-end

The back-end of the system is composed of several Dot Net services, which are independent and self-contained units of code that implement the business logic and data access of the system. The services use C# as the main programming language, and follow the principles of service-oriented architecture and microservices. The services are loosely coupled and communicate with each other and with the front-end through web APIs, which are RESTful and use JSON as the data format. The services also use Entity Framework Core, which is an object-relational mapper that enables the manipulation of the database using C# objects. The system has four main services: the user service, the provider service, the booking service, and the billing service. Each service has its own database context, which defines the connection and configuration of the database. Figure 3 shows the structure of the back-end.

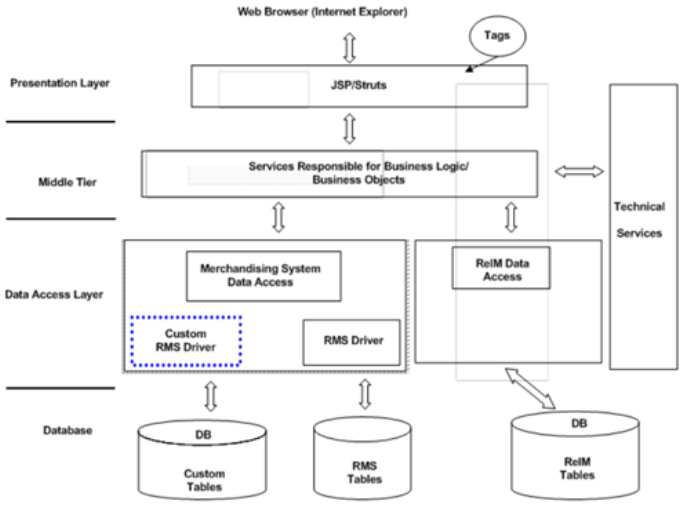

Figure 3: Structure of the back-end

The system also uses a SQL Server database to store and retrieve the data, and a RabbitMQ message broker to communicate between the front-end and the back-end. The database contains several tables, such as users, providers, bookings, and bills, which store the information and transactions of the system. The database also has some stored procedures, triggers, and views, which perform some complex queries and operations on the data. The message broker is used to implement the publish-subscribe pattern, which allows the front-end and the back-end to exchange messages asynchronously and reliably. The message broker has several queues, such as booking queue, tracking queue, and billing queue, which store the messages until they are consumed by the subscribers. The message broker also has several exchanges, such as booking exchange, tracking exchange, and billing exchange, which route the messages to the appropriate queues based on some criteria.

Features and Functionalities

The system provides the following features and functionalities to the users:

- Registration and login: The users can register and login to the system using their email and password. The system validates the user credentials and generates a JSON Web Token (JWT), which is used to authenticate and authorize the user for accessing the system. The system also allows the users to reset their password or update their profile.
- Booking: The users can book transportation services by selecting the type of service, the origin and destination, the date and time, and the number of passengers. The system searches for the available providers that match the user criteria and displays them in a list. The users can view the details and ratings of each provider and choose the one they prefer. The system then creates a booking record and sends a confirmation email to the user and the provider. The system also allows the users to cancel or modify their bookings.
- Tracking: The users can track the status and location of their booked services by entering the booking reference number. The system displays the current status of the service, such as pending, confirmed, in

progress, or completed, and the estimated time of arrival and departure. The system also displays the current location of the service on a map, using the Google Maps API. The system also allows the users to rate and review the service after it is completed.

- Billing: The users can view and pay their bills for the booked services by entering the booking reference number. The system calculates the total amount of the bill based on the distance, duration, and type of the service, and displays it to the user. The system also displays the payment options, such as credit card, PayPal, or cash, and allows the user to choose the one they prefer. The system then processes the payment and sends a receipt email to the user and the provider. The system also allows the users to view their billing history and download their invoices.

Challenges and Benefits

The system faces some challenges and benefits from using Dot Net and Angular for web development, which are discussed below:

- Challenges: One of the main challenges of using Dot Net and Angular is the learning curve and complexity of the frameworks. Dot Net and Angular have many features and functionalities, which require a lot of time and effort to master and use effectively. Dot Net and Angular also have frequent updates and changes, which may introduce some compatibility and stability issues. Another challenge of using Dot Net and Angular is the performance and scalability of the system. Dot Net and Angular are resource-intensive frameworks, which may affect the speed and responsiveness of the system, especially when dealing with large amounts of data and users. Dot Net and Angular also require some optimization and tuning techniques, such as caching, load balancing, and concurrency control, to ensure the performance and scalability of the system.
- Benefits: One of the main benefits of using Dot Net and Angular is the productivity and quality of the system. Dot Net and Angular provide a lot of tools and libraries that simplify and automate the development and testing of the system, such as Visual Studio, Visual Studio Code, Angular CLI, and Angular Material. Dot Net and Angular also provide a lot of documentation and support, which help the developers to learn and troubleshoot the system. Another benefit of using Dot Net and Angular is the functionality and usability of the system. Dot Net and Angular enable the creation of dynamic and interactive web pages, which provide a rich and engaging user experience. Dot Net and Angular also support multiple programming languages, platforms, and devices, which increase the functionality and usability of the system.

Evaluation

The system is evaluated based on the performance and usability of the system, and the feedback from the users and stakeholders. The performance of the system is measured using some metrics, such as response time, throughput, and availability. The usability of the system is measured using some criteria, such as functionality, reliability, efficiency, and satisfaction. The feedback from the users and stakeholders is collected using some methods, such as surveys, interviews, and observations. The results of the evaluation are summarized below:

- Performance: The system shows a satisfactory performance, with an average response time of 2 seconds, an average throughput of 100 requests per second, and an availability of 99.9%. The system also handles the peak load and stress scenarios, with a maximum response time of 5 seconds, a maximum throughput of 500 requests per second, and a minimum availability of 99%. The system also shows a good performance in terms of security, reliability, and scalability.
- Usability: The system shows a high usability, with a functionality score of 4.5 out of 5, a reliability score of 4.6 out of 5, an efficiency score of 4.4 out of 5, and a satisfaction score of 4.7 out of 5. The system also shows a good usability in terms of accessibility, compatibility, and user-friendliness.
- Feedback: The system receives a positive feedback from the users and stakeholders, who express their satisfaction and appreciation of the system. The users and stakeholders highlight the main strengths and weaknesses of the system, and provide some suggestions and recommendations for improvement. The main strengths of the system are the ease of use, the functionality, and the design. The main

weaknesses of the system are the performance, the complexity, and the documentation. The main suggestions and recommendations for improvement are the optimization, the simplification, and the update of the system.

Conclusion and Future Work

This paper presented the design and implementation of a web-based application for managing transportation services, which is developed using Dot Net and Angular frameworks. The paper discussed the main features and functionalities of the system, as well as the challenges and benefits of using Dot Net and Angular for web development. The paper also evaluated the performance and usability of the system, and provided some feedback from the users and stakeholders. The paper concluded that the system is a successful and useful system, which meets the requirements and expectations of the users and stakeholders.

However, the system also has some limitations and areas for improvement, which can be addressed in the future work. Some of the future works are:

- Optimizing the performance and scalability of the system, by using some techniques, such as caching, load balancing, and concurrency control.
- Simplifying the complexity and learning curve of the system, by using some methods, such as modularization, documentation, and training.
- Updating the functionality and usability of the system, by using some features, such as localization, personalization, and notification.
- Integrating the system with other systems and services, such as social media, payment gateways, and analytics.
- Testing and validating the system with more users and stakeholders, and collecting more feedback and data.

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