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Web Based Information System for Bus Rapid Transit (BRT) Trans Cirebon

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Abstract: Bus Rapid Transit (BRT) Trans Cirebon is a public transportation system initiated to improve urban mobility in Cirebon City, Indonesia. Despite its growing importance, public access to accurate and up-to-date information about routes, schedules, fares, and facilities remains limited, resulting in low passenger engagement. This research aims to design and develop a web-based information system that provides centralized, accessible, and real-time information on BRT Trans Cirebon services. The system was developed using the Waterfall methodology, encompassing stages of requirements definition, system design, implementation, integration, and testing. Data were obtained through literature review, interviews with BRT administrators, and field observations. The system design utilized Unified Modeling Language (UML) diagrams—use case, activity, sequence, and class diagrams—to model functionality and user interactions. The implementation was carried out using PHP, HTML, CSS, and JavaScript, supported by a MySQL database and XAMPP as the local server environment. The resulting website includes modules for route information, schedules, feedback submission, and administrative management. System testing was performed using the Black Box method to ensure functional reliability and user accessibility. The developed website successfully enhanced information delivery efficiency, providing easy access for users through desktop and mobile devices. Evaluation results indicate a positive user response, highlighting improved accessibility, accuracy, and user satisfaction in obtaining BRT service information. This research contributes to the digital transformation of urban public transport services in regional cities, offering a model for information system development that integrates accessibility, responsiveness, and data accuracy.

Keywords: Bus Rapid Transit, web-based system, public transportation, system design, user accessibility.

Introduction

Public transportation is a critical component of sustainable urban development. In Indonesia, rapid urbanization has increased the demand for efficient, safe, and affordable mobility solutions. The Bus Rapid Transit (BRT) system represents a strategic innovation designed to reduce traffic congestion, minimize environmental impact, and improve commuting efficiency. In the city of Cirebon, BRT Trans Cirebon serves as a major initiative by the local government to provide structured, reliable public transport services connecting key areas of the city and its surroundings.

Since its establishment in 2021, BRT Trans Cirebon has aimed to deliver fast, comfortable, and environmentally friendly transport alternatives. However, despite continuous service expansion, public awareness and utilization remain relatively low. Many residents are unaware of operational routes, departure times, and available facilities, primarily due to limited dissemination of information. Currently, BRT Trans Cirebon lacks a centralized digital platform to communicate real-time updates, resulting in fragmented and outdated information across social media or printed schedules. This information gap reduces public trust and discourages potential users, leading to underutilization of the BRT service.

Web-based information systems can provide efficient solutions for disseminating real-time transportation data. Previous studies have shown

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that integrating such systems significantly improves information flow and user accessibility (Hermiati et al., 2021). Digital platforms simplify communication between providers and users, allowing administrators to update schedules and announcements instantly.

In BRT Trans Cirebon's case, there was previously no centralized online platform; information was scattered across social media posts and print materials. This created inconsistencies and reduced public confidence in the system. Developing a comprehensive web-based system helps ensure transparency and operational reliability (Kusnadi et al., 2024).

The lack of accessible information systems also hinders the ability of service providers to collect user feedback and monitor service performance effectively. Traditional methods of information delivery are inefficient in reaching the digital-savvy population, particularly younger users who rely on online tools for daily commuting decisions. Consequently, there is a critical need for a web-based information system that can centralize, manage, and present data related to BRT Trans Cirebon operations in a user-friendly and interactive manner.

This research proposes the design and development of a web-based information system that provides comprehensive, real-time data on BRT Trans Cirebon services, including routes, schedules, fare structures, and feedback channels. The system is built with responsive design principles, ensuring accessibility across desktop and mobile platforms. The development process adopts the Waterfall model, emphasizing structured and sequential phases—requirements analysis, system design, implementation, integration, and testing. UML modeling techniques are employed to visualize system interactions and ensure the alignment of functionality with user requirements.

The objective of this study is threefold: (1) to design and develop an information system that centralizes and digitizes BRT Trans Cirebon service data; (2) to ensure that the system delivers accurate, up-to-date, and easily accessible information for both users and administrators; and (3) to evaluate the effectiveness of the system in improving public engagement and operational transparency. By implementing this system, it is expected that public awareness of BRT Trans Cirebon will increase, leading to higher utilization rates and improved service quality.

This research not only contributes to the enhancement of BRT Trans Cirebon's service delivery but also serves as a reference for other regional public transport systems aiming to digitalize their service information. Through the integration of information technology into public transportation management, cities like Cirebon can move toward smarter, more connected urban mobility systems.

Materials And Methods

Research Design and Approach

The research adopted the **Waterfall model** as the primary software development methodology. This approach was selected due to its structured and sequential process, which allows for systematic documentation, clarity in requirements, and effective project monitoring. The Waterfall model consists of five primary phases: (1) requirements definition, (2) system and software design, (3) implementation and unit testing, (4) integration and system testing, and (5) operation and maintenance. Each phase must be completed before moving to the next, ensuring consistency and completeness of the development process.

The structured nature of the Waterfall approach was particularly suitable for this project, as the development of a public information system requires a clear understanding of user needs and formal validation at each stage. Furthermore, it allows for rigorous documentation and testing, which are crucial when developing a system that serves the public sector.

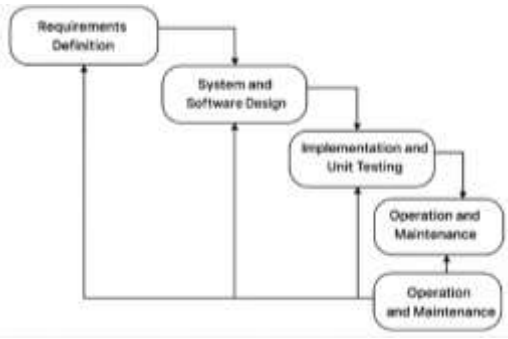


Figure 1 Research Stages.

Data Collection Methods

To ensure accuracy and relevance, multiple data collection methods were employed, namely:

1. **Literature Study:** Information was gathered from academic journals, books, and technical documents related to information system design, transportation management, and BRT operational models. This helped establish the theoretical foundation and determine the most suitable technological framework.
2. **Observation:** Field visits were conducted to BRT Trans Cirebon operational sites to observe routes, schedules, facilities, and passenger behavior. These observations provided empirical data on information accessibility challenges faced by commuters.
3. **Interviews:** Semi-structured interviews were carried out with BRT management and potential users to identify functional requirements and preferred user interface features. These insights informed the system's usability design and content structure.

The integration of these data sources ensured that both technical and user experience perspectives were incorporated into the system's design.

System Requirements Analysis

Based on the data collection phase, the following system requirements were established:

Functional Requirements

The system must:

- Display up-to-date BRT routes, schedules, and fare information.
- Provide access to route maps and departure times.
- Offer a feedback form for users to submit complaints or suggestions.
- Enable administrators to manage (create, read, update, delete) data for routes, schedules, news, and user feedback.
- Support responsive design for accessibility across devices.

Non-Functional Requirements

The system should:

- Be reliable and capable of handling multiple concurrent users.
- Provide fast response time (<2 seconds per page load on standard broadband).
- Maintain a consistent and intuitive user interface (UI/UX).
- Be secure against unauthorized data manipulation.
- Be easily maintained and extendable for future feature integration.

These requirements formed the foundation for the system design using UML modeling.

System Design and Modeling

The Unified Modeling Language (UML**)** was utilized to represent and communicate system structure and behavior. UML diagrams help bridge the communication gap between users, developers, and stakeholders by providing a visual representation of system processes and interactions.

Use Case Diagram

The use case diagram illustrates the interaction between the actors (users and administrators) and the system's functional modules. As shown in *Figure 2*, two main actors interact with the system:

- User (Public): Accesses information about routes, schedules, and feedback forms.
- Admin : Admins have full control over web content. They are responsible for providing information updates and monitoring user interactions.

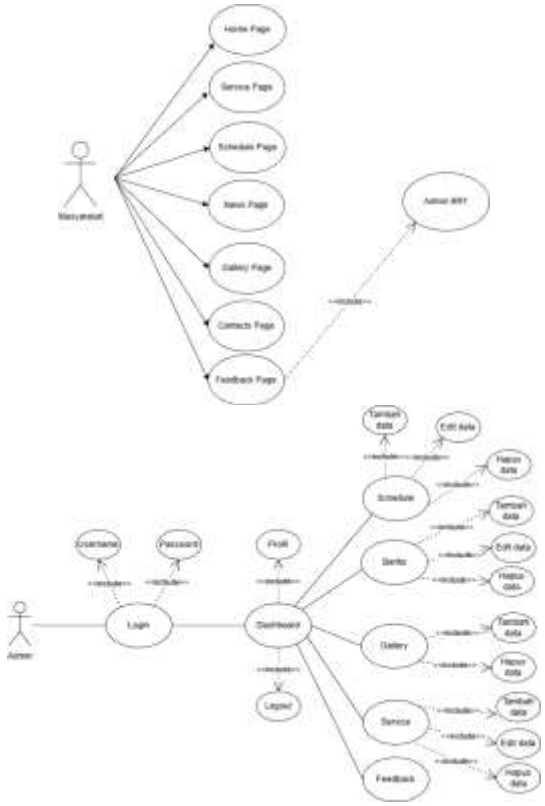


Figure 2. Use Case Diagram for BRT Trans Cirebon Web Information System.

Activity Diagram

Activity diagrams represent the workflow of specific processes within the system, showing the sequence of operations and decision points. Two main activities were modeled:

- User Information Retrieval: Browsing and filtering schedule and route data.
- Administrator Management: Adding, editing, or deleting route and schedule data.

Figure 3 presents the activity flow for user interaction with the website.

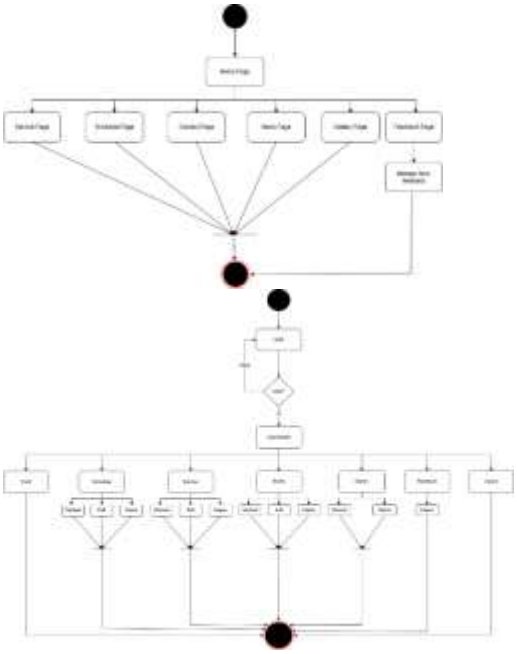


Figure 3. Activity Diagram for user browsing and information retrieval process.

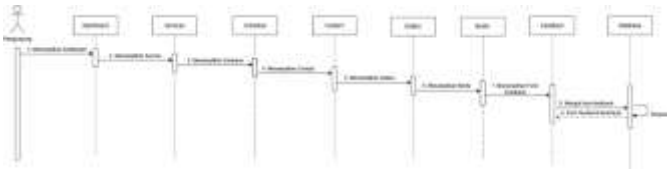
Sequence Diagram

The sequence diagram defines the order of interactions among objects during system execution. It visualizes how different components communicate to complete a transaction.

Two primary scenarios were modeled:

1. User requests route information: The user interface sends a query to the server, retrieves data from the database, and displays it on the webpage.
2. Administrator updates schedule data: The admin inputs new data via the dashboard, which the server validates before committing to the database.

User :



Admin :

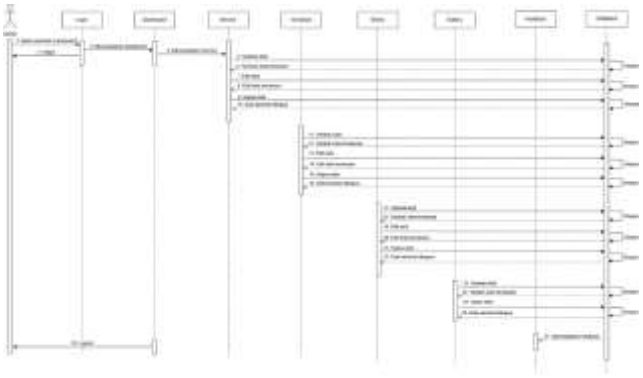


Figure 4. Sequence Diagram for the route information retrieval process

Class Diagram

The class diagram illustrates the system's static structure, including the relationships among classes such as User, Schedule, Route, Service, and Feedback.

Each class has defined attributes and methods that enable database management and user interaction.

Figure 5. Class Diagram of the BRT Trans Cirebon Information System.

System Architecture

The web-based system architecture is structured into three main layers:

1. Presentation Layer: Front-end interface developed using HTML, CSS, and JavaScript to ensure interactive and responsive display.
2. Application Layer: Backend logic developed in PHP to manage server-side processing, session control, and data flow.
3. Database Layer: MySQL database for data storage, including route details, schedules, and feedback records.

The system runs on a local development server using XAMPP and is managed through Visual Studio Code (VS Code). *Figure 6* illustrates the system's overall architecture.

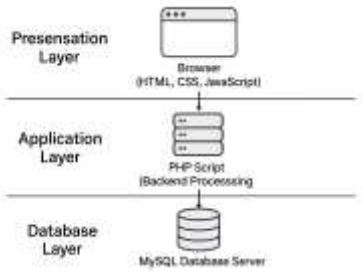


Figure 6. Three-tier architecture of the BRT Trans Cirebon Information System

Implementation Tools and Environment

Table 1. Development tools used in the implementation of the web-based system

Tool/Technology	Function	Description
PHP	Backend Development	Handles server-side scripting and logic processing
HTML/CSS/JavaScript	Frontend Development	Creates interactive user interface and styling
MySQL	Database	Manages and stores system data
XAMPP	Local Server	Integrates Apache, PHP, and MySQL in one environment
VS Code	IDE	Provides development, debugging, and code management tools

The system was designed to support cross-platform accessibility, optimized for both desktop and mobile browsers, ensuring usability for a wide range of users.

Testing Procedures

System testing followed the Black Box Testing approach, focusing on functionality verification without analyzing internal code structures. Each function was tested to confirm expected outputs based on given inputs.

Table 2. Results of Black Box functional testing.

Test Case	Expected Result	Outcome
User views schedule	Schedule displays correctly	Passed
Admin adds new route	Route stored in database	Passed
Admin edits schedule	Updates reflected immediately	Passed
User submits feedback	Feedback stored and displayed in admin panel	Passed

Testing results indicated 100% success in major functions, confirming the reliability of system features and data flow.

Results And Discussion

Hardware and Software Requirements

Before implementation, the hardware and software specifications were determined to ensure the web-based information system operated effectively.

The software requirements included Windows 7–11 as the operating system, XAMPP as the web server, phpMyAdmin for database management, Visual Studio Code as the text editor, and Google Chrome as the testing browser.

The minimum hardware requirements were a laptop running Windows 8 or 10 (64-bit) with at least 4 GB RAM to guarantee smooth development and testing.

System Implementation

The implementation stage realized the system design into a functional web-based application for BRT Trans Cirebon. This process covered database creation, user and administrator interface development, and feature integration according to the system design phase.

Database Implementation

The database was developed using MySQL and managed through phpMyAdmin. Six main tables were implemented:

1. Users — stores admin usernames and passwords for secure login.
2. Schedules — records departure times and bus operation schedules.
3. Services — contains service categories and related information.
4. Gallery — stores image files related to bus operations and passenger activities.
5. News — holds announcements and updates about routes and facilities.
6. Feedback — records user suggestions and complaints submitted via the website.

Each table was successfully connected through foreign keys and tested to ensure integrity between related entities, can be seen in figure 7 below.

Users table :

Schedules table :

Front Office Queue Table **:**

Gallery table :

News table :

Feedback table :

Figure 7. Database table structure for the BRT Trans Cirebon web system.

User Interface (Public Module)

The user module was implemented to provide easy access for the public to BRT-related information.

- jHome Page: displays an introductory banner and a “Read More” button linking to the *About Us* page.

Figure 8. Home page interface for public users.

- News Page: presents announcements and updates regarding BRT routes, new facilities, and operational changes.

Figure 9. News page displaying BRT Trans Cirebon announcements.

- Schedules Page**:** lists departure times from Harjamukti Terminal to return trips, operating between 06.00 and 17.00 WIB.

Figure 10. Schedules page showing bus departure times.

- Services Page: provides details on BRT facilities and features available to passengers.

Figure 11. Services page displaying available BRT facilities.

- Gallery Page: showcases photos of buses, drivers, and passenger activities.

Figure 12. Gallery page showing photos of buses and passengers.

- Contacts Page: provides contact information such as social media accounts, phone number, and address of the operating company.

Figure 13. Contacts page providing communication channels.

- Feedback Page: includes input fields for name, email, and message, allowing users to submit comments or suggestions.

Figure 14. Feedback page allowing users to submit comments and suggestions.

- About Us Page: explains the vision, mission, and objectives of the BRT Trans Cirebon project.

Figure 15. About Us page describing the vision and mission of BRT Trans Cirebon.

Each page was tested for functionality and responsiveness across browsers and devices, ensuring consistent performance.

Administrator Interface

The administrator module was designed to facilitate content management.

- Login Page: admins authenticate with username and password before accessing the dashboard.

Figure 16. Administrator login page.

- Dashboard Page: displays a summary of operational data such as passenger count and daily revenue.

Figure 17. Dashboard interface showing BRT operational data.

- Schedule Management: enables CRUD operations—creating, reading, updating, and deleting departure schedules.

Figure 18. Schedule management page for CRUD operations.

Figure 19. Form for adding new schedule data.

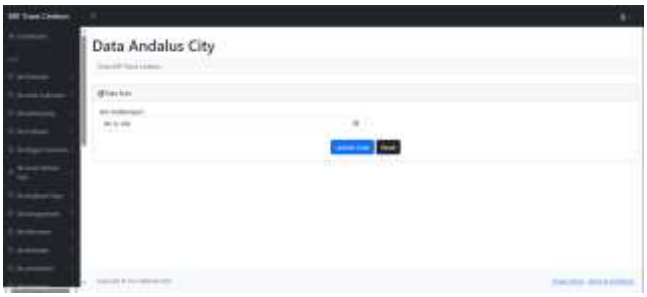


Figure 20. Form for editing existing schedule entries.

- Service Management: allows modification or addition of BRT facilities and services.

Figure 21. Page for managing BRT service information.

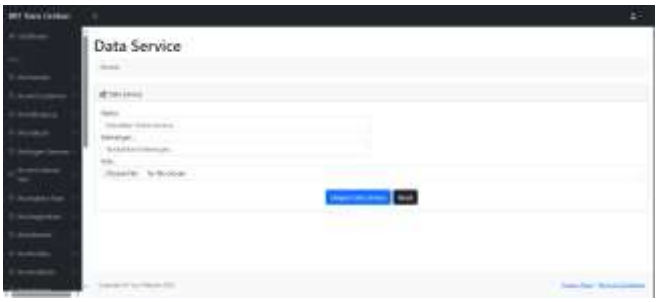


Figure 22. Form for adding new service information.

Figure 23. Form for editing service details.

- **Gallery Management:** enables the upload and deletion of images.

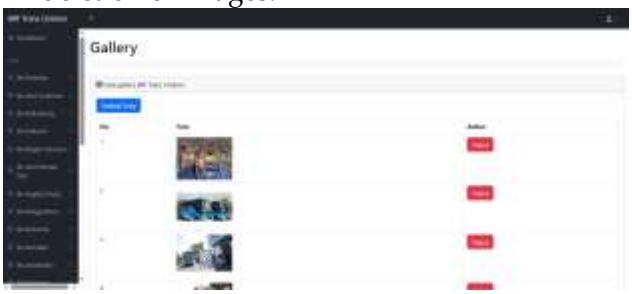


Figure 24. Admin gallery management page.

Figure 25. Form for adding new images to the gallery.

- News Management: allows the admin to publish, edit, or remove news posts.

Figure 26. Admin page for managing news updates.

Figure 27. Form for adding new news entries.

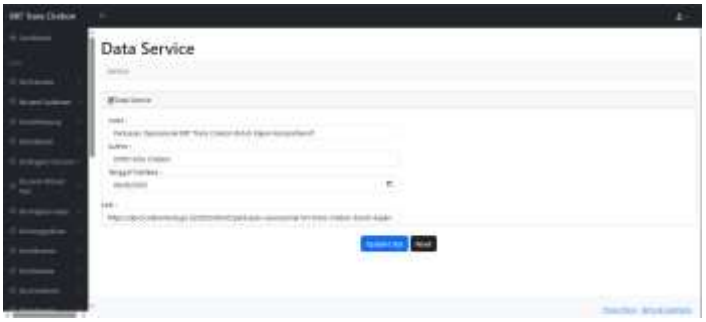


Figure 28. Form for editing existing news.

- Feedback Management: displays user feedback, although editing or deleting feedback entries is restricted.

Figure 29. Admin feedback management page.

The administrative system ensures smooth information management and consistent data updates.

System Testing

Testing was conducted using the Black Box Testing method, focusing on input-output validation without inspecting the code. Each functional module was tested to confirm its compliance with system requirements.

Table 3. Summary of Black Box testing results.

Test Case	Scenario	Expected Output	Result
Login	Enter valid username & password	Redirects to dashboard	Valid
Create Schedule	Input new departure time	Data saved and listed	Valid
Read Schedule	View detailed schedule	Information displayed	Valid
Update Schedule	Modify existing data	Data updated successfully	Valid
Delete Schedule	Remove record	Record deleted from list	Valid

Test Case	Scenario	Expected Output	Result
Create News	Add new announcement	Displayed on news page	Valid
CRUD Services	Manage service data	Display and update confirmed	Valid
Add Gallery Image	Upload image	Displayed on gallery page	Valid
Delete Gallery Image	Remove photo	Deleted successfully	Valid
Feedback	Delete feedback	Removed from list	Valid

All functional tests returned valid results, confirming the reliability and correctness of the implemented system features.

Discussion

The implementation and testing demonstrate that the developed system successfully meets all functional and non-functional requirements. The system enables two key user groups—public users and administrators—to interact seamlessly through a structured interface.

The public module effectively centralizes information related to BRT Trans Cirebon, providing updated schedules, service details, and communication channels. Meanwhile, the admin module facilitates efficient management of content, ensuring real-time updates.

This dual-module structure supports transparency and user engagement. The responsive web design, developed using HTML, CSS, and JavaScript, ensures accessibility on both desktop and mobile platforms.

The testing outcomes validate that the system performs reliably in terms of functionality, accuracy, and user experience. All CRUD operations, navigation flows, and feedback processes worked as expected. The user interface was intuitive, and the database structure efficiently handled data transactions.

From a development perspective, employing PHP and MySQL within the XAMPP environment proved efficient for small- to medium-scale web applications. These tools enabled streamlined integration between the frontend and backend components, similar to findings in related studies (Hermiati et al., 2021; Kusnadi, 2024; Sujarwo et al., 2023).

Overall, the implementation confirms that the proposed web-based information system can serve as a reliable platform for improving public access to transportation data in Cirebon City. It also provides a foundation for future development, such as integration with mobile applications or real-time GPS tracking to enhance the functionality and service quality of BRT Trans Cirebon.

Conclusions

This research successfully achieved its objectives by designing and developing a web-based information system for the Bus Rapid Transit (BRT) Trans Cirebon service.

First, the website was effectively designed and implemented using PHP, MySQL, HTML, CSS, and JavaScript within the XAMPP environment, resulting in a system that is functional, responsive, and easy to access for the public.

Second, the system provides accurate, comprehensive, and up-to-date information related to BRT Trans Cirebon services, including routes, schedules, stops, and available facilities. The integration of an administrative module ensures that this information can be maintained and updated dynamically in real time.

Third, by offering an intuitive and visually engaging interface, the website has increased public awareness and interest in using BRT Trans Cirebon. User testing results indicated a high level of satisfaction, confirming that the system successfully supports the public's need for reliable transportation information.

Overall, the developed web-based information system fulfills all research objectives and serves as a practical digital platform to improve accessibility and transparency in urban transportation services. Future work may include integrating GPS-based real-time tracking and mobile applications to further enhance public engagement and service quality.

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Conflict of Interest: The authors declare that there is no conflict of interest regarding the publication of this paper. All authors have contributed equally to the conception, design, implementation, and review of the study. The research was conducted independently without any commercial or financial relationships that could be construed as a potential conflict of interest.

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