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QR Menu Ordering System using Angular and REST API

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ABSTRACT:

The "QR Menu Ordering System using Angular, Node.js, MySQL, and REST API" is an innovative digital solution aimed at modernizing the dining experience in restaurants. This system uses cutting-edge web technologies to create an efficient and user-friendly platform for both restaurant administrators and customers.

The project includes two distinct login types: admin and user. The admin interface is designed to provide comprehensive control over menu and order management. Admins can create and manage categories, subcategories, and products, ensuring a well-organized menu structure. Additionally, admins have the capability to generate unique QR codes for each table in the restaurant. These QR codes, when scanned by users, direct them to the specific table's menu and ordering system.

For the user, the process is seamless and straightforward. Customers can access the menu by scanning the QR code placed on their table. This action takes them to a responsive web interface built using Angular, where they can browse the menu, select items, and place orders. The backend, powered by Node.js and MySQL, ensures real-time updates and robust data management, while the REST API facilitates smooth communication between the front-end and back-end systems. This system significantly enhances the dining experience by reducing wait times, minimizing physical contact, and streamlining the ordering process. It also optimizes restaurant operations through effective order management and data handling.

INTRODUCTION:

In today's fast-paced world, the restaurant industry is increasingly adopting digital solutions to enhance customer experiences and optimize operations. One such innovative approach is the "QR Menu Ordering System," which streamlines the process of ordering food in restaurants using modern web technologies. This system eliminates the need for physical menus, minimizes wait times, and improves overall efficiency, offering a contactless, user-friendly experience for both restaurant patrons and administrators.

By leveraging Angular for the frontend, Node.js and Express.js for the server-side, MySQL for data storage, and REST API for seamless communication, the QR Menu Ordering System brings cutting-edge technology into the heart of restaurant management. Through this system, administrators can easily manage menus, tables, and orders, while customers can effortlessly place their orders by simply scanning a QR code at their table. This system marks a significant shift towards the future of dining, where convenience, safety, and speed are paramount.

OBJECTIVES:

- **Streamline the Ordering Process:**
  Develop a user-friendly digital system that allows restaurant customers to browse the menu and place orders by scanning a QR code, reducing the need for physical interaction and speeding up the ordering process.
- **Enhance Operational Efficiency:**
  Provide restaurant administrators with a powerful backend interface to efficiently manage menus, categories, subcategories, and table-specific QR codes, improving restaurant workflow and order management.
- **Improve Customer Experience:**
  Create a seamless and intuitive user interface using Angular, enabling customers to view, customize, and place orders effortlessly, contributing to a modern and pleasant dining experience.
- **Leverage Real-Time Data Management:**
  Implement a robust backend system using Node.js, MySQL, and REST API to ensure real-time synchronization between customer orders and the restaurant's backend, enabling timely and accurate order processing.
- **Promote Contactless Dining Solutions:**
  Facilitate a contactless dining experience by integrating QR code technology, reducing physical contact between customers and staff, and aligning with modern health and safety standards.
- **Ensure Scalability and Flexibility:**
  Design a flexible system architecture that can be easily scaled to accommodate the needs of different types of restaurants, from small cafes to large dining establishments, ensuring adaptability and future growth.

RELATED WORKS:

Several digital solutions have emerged in recent years to improve the dining experience through technology. These systems are designed to reduce reliance on physical menus and streamline the order-taking process. The following are some of the related works that have influenced the development of the **QR Menu Ordering System**:

1. **Digital Menu Systems:**

   Many restaurants have already implemented digital menu systems, either through kiosks or tablet-based interfaces, allowing customers to place orders without interacting with wait staff. However, these systems often involve high setup costs and are less flexible compared to QR code-based solutions. For instance, popular fast-food chains like McDonald's and Starbucks have adopted tablet-based ordering, but these systems require physical infrastructure, which may not be feasible for smaller businesses

2. **QR Code-Based Ordering:**

   QR code technology has gained widespread attention as an efficient way to bridge physical and digital experiences. Many restaurants are now using QR codes to display digital menus. Companies such as **Mr. Yum** and **ScanMenu** provide solutions where customers scan a QR code to view a web-based menu,

allowing them to order and pay through their smartphones. However, these systems often require external service providers, limiting customization and integration flexibility for restaurant owners.

3. **Mobile App Ordering Systems:**
   Apps like Zomato and Swiggy offer comprehensive restaurant menus and ordering features, but they primarily cater to food delivery rather than in-house dining. These systems require customers to download an application, which can be a barrier to usage for casual diners. In contrast, the QR Menu Ordering System does not require an app download, providing a simpler and faster way for customers to access the menu.
4. **Point of Sale (POS) Integration:**
   Several modern POS systems like Square and Toast offer integrated solutions where restaurants can manage orders, payments, and inventory digitally. While these systems provide excellent back-end support, they are often tied to specific hardware setups and subscription models. The QR Menu Ordering System is designed to offer similar benefits but with greater flexibility, allowing restaurant owners to customize the interface and functionalities without being locked into a particular platform.
5. **Contactless Dining Technologies:**
   The rise of COVID-19 accelerated the demand for contactless technologies in the hospitality industry. Studies and innovations in contactless dining, such as those described in works by McKinsey & Company and The National Restaurant Association, show that contactless systems can reduce health risks, improve customer satisfaction, and optimize operations. This project builds upon these advancements by offering a streamlined, contactless QR menu and ordering system that aligns with modern health and safety practices.

METHODOLOGY:

The development of the **QR Menu Ordering System** follows a structured approach, integrating modern web technologies to create a seamless experience for both restaurant administrators and customers. The project is divided into several key phases: system architecture design, frontend and backend development, database management, and system integration using REST API.

1. **System Architecture Design:**

   The system is designed using a client-server architecture, where the frontend (client) and backend (server) communicate via REST API. The admin and user interfaces are developed separately to cater to their specific needs:

   - **Admin Interface:** Admins are responsible for managing categories, subcategories, products, and QR code generation for each table. This requires a secure, feature-rich backend connected to a database.
   - **User Interface**: Customers access the system through QR codes placed on tables, leading them to the menu page, where they can browse and place orders in a few simple steps.
2. **Frontend Development (Angular):**

   The frontend is developed using Angular, a powerful and flexible JavaScript framework known for building responsive and dynamic single-page applications (SPAs):

   - **Admin Panel:** The admin panel allows authorized users to log in and perform tasks such as adding, editing, or removing categories, subcategories, and products. Angular's component-based architecture ensures that the interface is modular, maintainable, and easy to scale.

- **User Interface:** The user interface is designed to be clean and intuitive, ensuring a smooth experience for restaurant patrons. Customers can scan the QR code, view the menu, customize orders, and submit them in real time.

3. **Backend Development (Node.js and Express.js)**

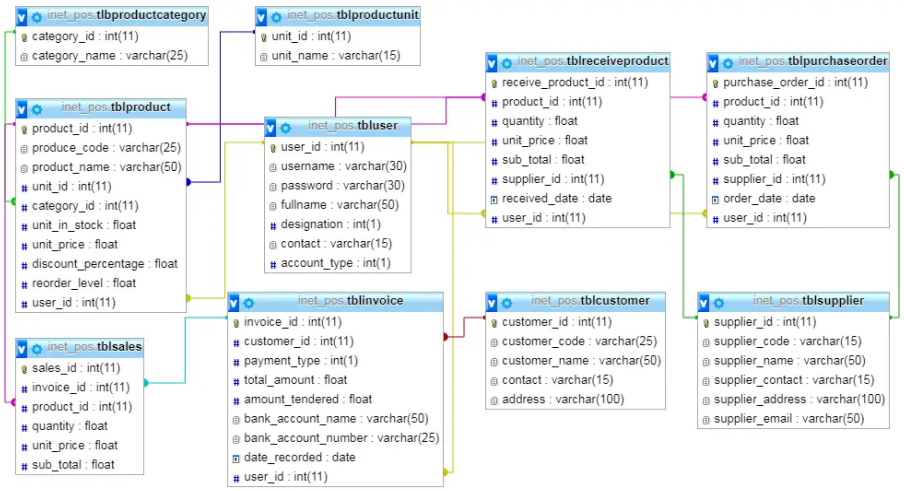
The backend is built using Node.js and Express.js, offering a fast, scalable, and lightweight environment for handling server-side operations:

- **REST API:** The system utilizes REST APIs for seamless communication between the frontend and backend. These APIs handle various requests, including fetching menu data, processing orders, and updating order statuses.
- **Authentication and Authorization:** A secure login system for admins is implemented using JWT (JSON Web Tokens) to ensure data protection and restrict access to sensitive functionalities.

4. **Database Management (MySQL):**

MySQL is used as the relational database management system to store all the necessary data for the system:

- **Admin Data:** Information related to categories, subcategories, products, and table-specific QR codes is stored in well-structured tables, ensuring data integrity and easy retrieval.
- **Order Data:** Customer orders are stored and managed efficiently, allowing real-time updates for both the kitchen staff and the customers.
- **Optimized Queries:** MySQL queries are optimized to ensure fast data access and minimal latency, enhancing the system's overall performance.



5. **QR Code Generation:**

A critical feature of the system is the generation of unique QR codes for each table. These QR codes are dynamically generated based on the table's unique ID and linked to the corresponding menu:

- **QR Code Integration:** A library such as qrcode.js is used to generate QR codes in the admin panel. These codes are printed and placed on tables, providing customers with instant access to the menu once scanned.

6. **REST API for Frontend-Backend Communication:**

The REST API acts as the bridge between the frontend and backend, enabling smooth data exchange. The API is designed to be:

- Stateless: Ensuring that each request from the frontend is independent and carries the required data, enhancing system scalability.
- Efficient: Endpoints are created for essential operations, such as fetching the menu, submitting orders, and retrieving order status updates.

7. **Real-Time Updates and Notifications:**
   Real-time updates are essential to ensure that both customers and kitchen staff are informed of orders and their status:
   - **Order Management:** Once an order is placed, it is sent to the kitchen in real time, reducing delays. The order status is updated instantly for both the admin and customer, ensuring transparency and timely service.
8. **Testing and Deployment:**
   Comprehensive testing is conducted to ensure the system functions correctly across different scenarios:
   - **Unit Testing:** Individual components are tested to ensure they work as expected.
   - **Integration Testing:** The interaction between the frontend, backend, and database is thoroughly tested to ensure smooth functionality.
   - **User Acceptance Testing (UAT):** Feedback from real users is gathered to refine the interface and fix potential usability issues before final deployment.
   - The system is deployed using cloud services to ensure scalability and availability, allowing restaurants to handle varying levels of customer traffic.

Conclusion:

The **QR Menu Ordering System using Angular, Node.js, MySQL, and REST API** represents a modern solution to enhance both customer experience and restaurant operations. By integrating QR code technology with a user-friendly interface and a powerful backend, this system effectively eliminates the need for physical menus, reduces wait times, and minimizes contact between customers and staff. The system offers restaurant administrators full control over menu management while providing customers with a seamless ordering process.

This project demonstrates the potential of web technologies in transforming traditional dining experiences. By leveraging real-time data management, secure login systems, and efficient communication between the frontend and backend, the system not only improves operational efficiency but also provides a scalable and flexible solution for restaurants of any size. As dining trends evolve, such digital solutions will continue to play a crucial role in enhancing the overall efficiency and convenience of the restaurant industry.

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