Task Management System Documentation

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Introduction

The Task Management System is a comprehensive web application designed to help small teams efficiently organize, assign, and track tasks. This document provides a detailed overview of the system's architecture, features, and implementation.

Project Overview

The Task Management System enables team members to create tasks, assign them to colleagues, track progress, and receive notifications about task updates. The application features a user-friendly interface with a dashboard that provides a quick overview of tasks based on various parameters such as due date, priority, and status.

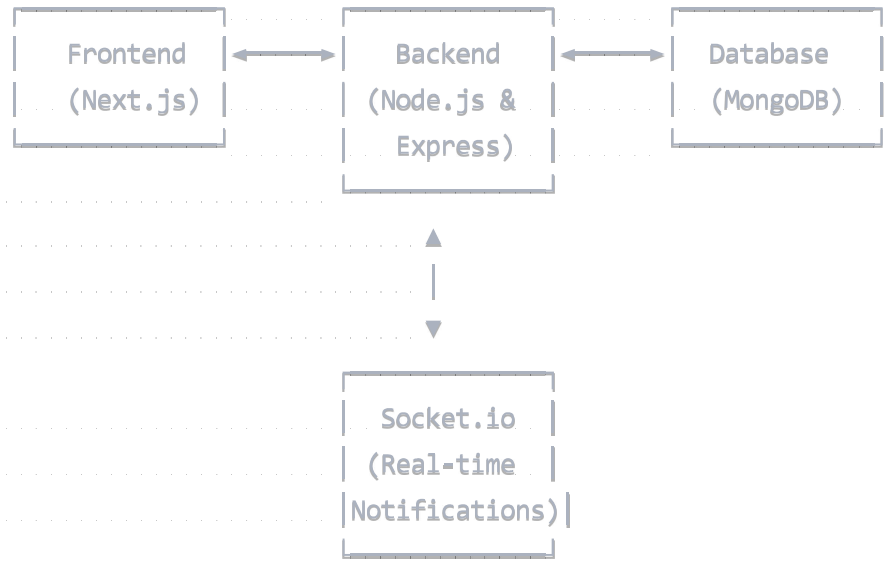
Target Users

- Small to medium-sized teams
- Project managers
- Team leaders
- Individual contributors

System Architecture

The Task Management System follows a modern web application architecture with separate frontend and backend components, connected via RESTful APIs.

High-Level Architecture



Technology Stack

- **Frontend**: Next.js (React framework)
- **State Management**: Redux Toolkit
- **Backend**: Node.js with Express.js
- **Database**: MongoDB
- **Real-time Communication**: Socket.io
- **Authentication**: JWT (JSON Web Tokens)
- **Version Control**: Git

Features and Functionalities

User Authentication

- Secure user registration with email verification
- Login with JWT authentication
- Password reset functionality
- Role-based access control (Admin, Manager, Team Member)

Task Management

- Create new tasks with detailed information:
  - Title
  - Description
  - Due date
  - Priority (Low, Medium, High, Urgent)
  - Status (To Do, In Progress, Review, Completed)
- Edit existing tasks
- Delete tasks (with appropriate permissions)
- View task details
- Track task history and changes

Team Collaboration

- Assign tasks to team members
- Transfer task ownership
- Add comments to tasks
- @mention functionality to notify specific team members
- Task discussion threads

Dashboard

The dashboard provides a centralized view of:

- Tasks assigned to the logged-in user
- Tasks created by the logged-in user
- Overdue tasks
- Tasks grouped by status
- Tasks sorted by priority
- Recent activities

Search and Filtering

- Search tasks by title or description
- Filter tasks by:
  - Status

    - Priority
    - Due date
    - Assignee
    - Creator
- Sort tasks by various parameters

Notifications

- Real-time notifications using Socket.io
- Email notifications for critical updates
- Notification preferences management
- In-app notification center

Technical Implementation

Frontend Architecture

The frontend is built using Next.js, which provides server-side rendering capabilities and an optimized React framework. The application follows a component-based architecture with reusable UI elements.

Key Frontend Libraries

- **Redux Toolkit**: For state management
- **React Hook Form**: For form validation
- **Axios**: For API requests
- **Socket.io-client**: For real-time communications
- **TailwindCSS**: For styling
- **React Icons**: For UI icons
- **React Datepicker**: For date selection

Backend Architecture

The backend follows an MVC (Model-View-Controller) architecture pattern, with clear separation of concerns:

- **Models**: Define the data structure and database interactions
- **Controllers**: Handle business logic and request processing
- **Routes**: Define API endpoints and route requests to appropriate controllers

- **Middlewares**: Handle authentication, logging, error handling, etc.

Key Backend Libraries

- **Express**: Web framework for Node.js
- **Mongoose**: MongoDB object modeling
- **Bcrypt**: Password hashing
- **JWT**: Authentication tokens
- **Socket.io**: Real-time communication
- **Nodemailer**: Email notifications
- **Multer**: File uploads
- **Joi**: Request validation

Database Schema

User Collection

```json
{
  "_id": "ObjectId",
  "name": "String",
  "email": "String",
  "password": "String (hashed)",
  "role": "String (admin, manager, member)",
  "profilePicture": "String (URL)",
  "createdAt": "Date",
  "updatedAt": "Date"
}
```

Task Collection

json

```
{
  "_id": "ObjectId",
  "title": "String",
  "description": "String",
  "createdBy": "ObjectId (ref: User)",
  "assignedTo": "ObjectId (ref: User)",
  "dueDate": "Date",
  "priority": "String (low, medium, high, urgent)",
  "status": "String (todo, in-progress, review, completed)",
  "attachments": ["String (URLs)"],
  "comments": [{
    "user": "ObjectId (ref: User)",
    "text": "String",
    "createdAt": "Date"
  }],
  "createdAt": "Date",
  "updatedAt": "Date"
}
```

Notification Collection

json

```
{
  "_id": "ObjectId",
  "recipient": "ObjectId (ref: User)",
  "sender": "ObjectId (ref: User)",
  "task": "ObjectId (ref: Task)",
  "type": "String (task-assigned, comment-added, etc.)",
  "message": "String",
  "read": "Boolean",
  "createdAt": "Date"
}
```

API Documentation

Authentication Endpoints

User Registration

- **Route**: `POST /api/auth/register`

- **Body**:

```json
{
  "name": "String",
  "email": "String",
  "password": "String",
  "role": "String (optional)"
}
```

- **Response**: User object with JWT token

User Login

- **Route**: `POST /api/auth/login`
- **Body**:

```json
{
  "email": "String",
  "password": "String"
}
```

- **Response**: User object with JWT token

Task Endpoints

Create Task

- **Route**: `POST /api/tasks`
- **Authentication**: Required
- **Body**:

```json
{
  "title": "String",
  "description": "String",
  "assignedTo": "ObjectId (optional)",
  "dueDate": "Date",
  "priority": "String",
  "status": "String"
}
```

- **Response**: Created task object

Get All Tasks

- **Route**: `GET /api/tasks`
- **Authentication**: Required
- **Query Parameters**:
  - `status`: Filter by status
  - `priority`: Filter by priority
  - `assignedTo`: Filter by assignee
  - `search`: Search in title or description
- **Response**: Array of task objects

Get Task by ID

- **Route**: `GET /api/tasks/:id`
- **Authentication**: Required
- **Response**: Task object

Update Task

- **Route**: `PUT /api/tasks/:id`
- **Authentication**: Required
- **Body**: Fields to update
- **Response**: Updated task object

Delete Task

- **Route**: `DELETE /api/tasks/:id`
- **Authentication**: Required
- **Response**: Success message

User Endpoints

Get All Users

- **Route**: `GET /api/users`
- **Authentication**: Required (Admin only)

- **Response**: Array of user objects

Get User Profile

- **Route**: `GET /api/users/profile`
- **Authentication**: Required
- **Response**: User object

Update User Profile

- **Route**: `PUT /api/users/profile`
- **Authentication**: Required
- **Body**: Fields to update
- **Response**: Updated user object

Notification Endpoints

Get User Notifications

- **Route**: `GET /api/notifications`
- **Authentication**: Required
- **Response**: Array of notification objects

Mark Notification as Read

- **Route**: `PUT /api/notifications/:id/read`
- **Authentication**: Required
- **Response**: Updated notification object

Frontend Components

Component Structure

Key UI Screens

1. **Login/Registration**: User authentication screens
2. **Dashboard**: Overview of tasks and statistics
3. **Task List**: Filterable list of all accessible tasks
4. **Task Details**: Detailed view of a specific task
5. **Create/Edit Task**: Form for task creation and editing
6. **User Profile**: User information and settings
7. **Admin Panel**: User management for administrators

Authentication and Authorization

Authentication Flow

1. User submits login credentials
2. Server validates credentials and generates JWT token
3. Token is stored in local storage and included in API requests
4. Token expiration is handled with automatic refresh or logout

Role-Based Access Control

The system implements three primary roles:

1. **Admin**:
   - Full system access
   - User management
   - System settings
   - All task operations
2. **Manager**:
   - Create projects and tasks
   - Assign tasks to team members
   - View all team tasks
   - Generate reports
3. **Team Member**:
   - View assigned tasks
   - Update task status

- Create tasks for self
- Comment on tasks

Permission Structure

```javascript
const permissions = {
  'create:task': ['admin', 'manager', 'member'],
  'read:task': ['admin', 'manager', 'member'],
  'update:task': ['admin', 'manager', 'member'],
  'delete:task': ['admin', 'manager'],
  'assign:task': ['admin', 'manager'],
  'create:user': ['admin'],
  'read:user': ['admin'],
  'update:user': ['admin'],
  'delete:user': ['admin']
};
```

Real-time Notifications

The notification system uses Socket.io to provide real-time updates to users.

Socket.io Implementation

1. Socket connection is established upon user login
2. Users join a personal room based on their user ID
3. Server emits events to specific users or rooms when relevant actions occur
4. Client listens for events and updates the UI accordingly

Notification Types

- Task assignment
- Task status change
- Due date reminders
- Comment mentions
- Task completion

Socket Events

```javascript
// Server-side events
socket.emit('taskAssigned', { taskId, assignedTo, taskTitle });
socket.emit('taskUpdated', { taskId, updatedFields });
socket.emit('commentAdded', { taskId, comment });

// Client-side listeners
socket.on('taskAssigned', (data) => {
  // Update Redux store and show notification
});
socket.on('taskUpdated', (data) => {
  // Update task in UI
});
socket.on('commentAdded', (data) => {
  // Update comments list
});
```

State Management

The application uses Redux Toolkit for state management, providing a centralized store for application data.

Redux Store Structure

```
store/
├── index.js (Configure store)
├── authSlice.js (Authentication state)
├── taskSlice.js (Tasks state)
├── userSlice.js (Users state)
└── notificationSlice.js (Notifications state)
```

Key Redux Slices

Auth Slice

Manages authentication state, user information, and login/logout functionality.

```javascript
const authSlice = createSlice({
  name: 'auth',
  initialState: {
    user: null,
    token: null,
    isAuthenticated: false,
    loading: false,
    error: null
  },
  reducers: {
    // Auth reducers
  },
  extraReducers: (builder) => {
    // Async thunk handlers
  }
});
```

Task Slice

Manages task data, including fetching, creating, updating, and filtering tasks.

```javascript
const taskSlice = createSlice({
  name: 'tasks',
  initialState: {
    tasks: [],
    filteredTasks: [],
    currentTask: null,
    loading: false,
    error: null,
    filters: {
      status: null,
      priority: null,
      assignedTo: null,
      search: ''
    }
  },
  reducers: {
    // Task reducers
  },
  extraReducers: (builder) => {
    // Async thunk handlers
  }
});
```

Notification Slice

Manages user notifications, including real-time updates.

```javascript
const notificationSlice = createSlice({
  name: 'notifications',
  initialState: {
    notifications: [],
    unreadCount: 0,
    loading: false,
    error: null
  },
  reducers: {
    // Notification reducers
  },
  extraReducers: (builder) => {
    // Async thunk handlers
  }
});
```

Testing

Testing Strategy

The application employs a comprehensive testing strategy:

1. **Unit Tests**: Test individual components and functions
2. **Integration Tests**: Test interactions between components
3. **API Tests**: Test backend API endpoints
4. **End-to-End Tests**: Test complete user workflows

Testing Tools

- **Jest**: JavaScript testing framework
- **React Testing Library**: Frontend component testing
- **Supertest**: API endpoint testing
- **MongoDB Memory Server**: Database testing

Deployment

Deployment Architecture

The application is deployed using a modern cloud infrastructure:

Deployment Process

1. **Frontend**: Deployed on Vercel with continuous integration from GitHub
2. **Backend**: Deployed on Heroku with automatic deployments
3. **Database**: Hosted on MongoDB Atlas with proper backup strategies
4. **Environment Variables**: Managed securely in deployment platforms

Future Enhancements

1. **Enhanced Reporting**: Generate detailed reports on task completion, user productivity, etc.
2. **Time Tracking**: Add time tracking functionality for tasks
3. **Project Management**: Group tasks into projects with project-level metrics
4. **Mobile Application**: Develop a companion mobile app
5. **Integration with Third-party Tools**: Calendar, email, Slack, etc.
6. **Advanced Analytics**: Task completion trends, bottleneck identification
7. **File Management**: Enhanced file attachment and organization
8. **Custom Workflows**: Allow teams to create custom task workflows

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Conclusion

The Task Management System provides a robust solution for small teams to effectively manage their tasks and collaborate. With features like real-time notifications, role-based access control, and comprehensive task management capabilities, the system streamlines team productivity and project tracking.