**Ebus Management Based Current Location System Project Report**

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### Introduction

The Ebus Management Based Current Location System is designed to provide real-time tracking of buses, allowing users to view the current location of buses on a map, see estimated arrival times, and manage bus routes and schedules. This system aims to improve the efficiency and reliability of public transportation.

**Project Objectives**

* To provide real-time bus tracking.
* To display current bus locations on a map.
* To estimate bus arrival times at various stops.
* To manage and update bus routes and schedules.
* To enhance the user experience for passengers and operators.

**Technologies Used**

* **Frontend**: HTML, CSS, JavaScript
* **Backend**: Firebase (Firestore, Firebase Authentication, Firebase Hosting)
* **APIs**: Google Maps API

### System Architecture

The system architecture consists of three main components:

1. **Frontend**: User interface designed with HTML, CSS, and JavaScript.
2. **Backend**: Firebase for real-time database, authentication, and hosting.
3. **APIs**: Integration with Google Maps API for map display and location services.

### Implementation Details

**HTML**: Structure of the web pages including forms, maps, and displays.

1. **CSS**: Styling for the web pages to ensure a responsive and user-friendly interface.
2. **JavaScript**: Client-side scripting to handle user interactions, API calls, and real-time updates.

**HTML**

Html

<!DOCTYPE html>

<html lang="en">

<head>

<meta charset="UTF-8">

<meta name="viewport" content="width=device-width, initial-scale=1.0">

<title>Ebus Management System</title>

<link rel="stylesheet" href="styles.css">

</head>

<body>

<div id="map"></div>

<script src="https://maps.googleapis.com/maps/api/js?key=YOUR\_API\_KEY&callback=initMap" async defer></script>

<script src="app.js"></script>

</body>

</html>

**CSS**

body, html {

height: 100%;

margin: 0;

font-family: Arial, sans-serif;

}

#map {

height: 100%;

width: 100%;

}

**JavaScript**

Javascript

function initMap() {

const map = new google.maps.Map(document.getElementById("map"), {

center: { lat: -34.397, lng: 150.644 },

zoom: 8,

});

const busLocationRef = firebase.firestore().collection('busLocations');

busLocationRef.onSnapshot(snapshot => {

snapshot.forEach(doc => {

const busData = doc.data();

new google.maps.Marker({

position: { lat: busData.latitude, lng: busData.longitude },

map: map,

title: busData.busNumber

});

});

});

}

**Backend**

**Firestore**: Real-time database to store bus locations, routes, and schedules.

1. **Firebase Authentication**: Secure user authentication for operators and passengers.
2. **Firebase Hosting**: Hosting the web application.

**Firestore Structure**

* **Collections**: busLocations, busRoutes, busSchedules
* **Documents**: Each document represents an individual bus or route with fields like latitude, longitude, routeNumber, etc.

### Features

* **Real-Time Bus Tracking**: View current bus locations on a map.
* **Estimated Arrival Times**: Calculate and display expected arrival times at stops.
* **Route Management**: Add, update, and delete bus routes and schedules.
* **User Authentication**: Secure login for system operators and passengers.

**User Interface Design**

* **Homepage**: Displays the map with real-time bus locations.
* **Route Management**: Interface for operators to manage bus routes.
* **Schedule Management**: Interface for updating bus schedules.
* **Login/Signup**: User authentication pages.

**Challenges and Solutions**

* **Real-Time Updates**: Ensuring real-time location updates using Firestore’s real-time capabilities.
* **Map Integration**: Integrating Google Maps API for dynamic map displays and markers.
* **Authentication**: Implementing secure and user-friendly authentication using Firebase Authentication.

**Conclusion**

The Ebus Management Based Current Location System enhances the public transportation experience by providing real-time tracking and efficient route management. This project successfully integrates modern web technologies and Firebase to deliver a robust and scalable solution.

**Future Enhancements**

* **Mobile App**: Develop a mobile application for better accessibility.
* **Advanced Analytics**: Implement analytics for route optimization and performance tracking.
* **User Notifications**: Provide real-time notifications for bus arrivals and delays.
* **Offline Capabilities**: Ensure functionality during intermittent internet connectivity.