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AI-Smart College Bus Tracking and Notification System

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ABSTRACT:

In recent years, many smart transportation systems have been developed to improve the efficiency and reliability of public and college transportation. However, students often face difficulties in knowing the exact location of their college buses, estimated arrival times, and unexpected delays. In our project, “**AI-Smart College Bus Tracking and Notification System**,” we aim to solve these problems by developing a smart web-based application that provides real-time bus tracking and timely notifications.

In this system, students can view bus locations, routes, and estimated arrival times through an integrated Google Maps interface. The system uses machine learning techniques to estimate arrival time based on available distance and speed information. Drivers can update bus location and trip details, while administrators can manage bus, student, driver, and route information. Smart notifications provide updates about bus arrivals, delays, and trip status. The system is developed using HTML, CSS, JavaScript, Python Flask, and MongoDB. This project mainly focuses on improving transportation visibility, reducing students' waiting time, and making college bus management more efficient and user-friendly.

Keywords: Artificial Intelligence, College Bus Tracking, Google Maps, ETA Prediction, Machine Learning, Smart Notifications, Web Application.

Introduction:

Artificial Intelligence is widely used in many applications such as smart transportation, traffic monitoring, route optimization, and prediction systems. During our observation, we found that students often face difficulties in identifying the real-time location of college buses and knowing their estimated arrival times. Unexpected traffic conditions and bus delays can also create inconvenience for students.

To overcome these issues, we developed the **AI-Smart College Bus Tracking and Notification System**. The main idea of this project is to provide real-time bus tracking using Google Maps, estimate bus arrival times using machine learning techniques, and send notifications about bus arrivals and delays. The system also allows drivers to update bus information and administrators to manage students, drivers, buses, and routes. This project aims to make college transportation more reliable, efficient, and user-friendly.

Objectives:

- To track college buses in real time using Google Maps.
- To provide timely notifications about bus arrivals and delays.
- To manage student, driver, bus and route information efficiently.

System Structure:

The AI-Smart College Bus Tracking and Notification System is divided into three main parts:

- **Frontend:** Developed using HTML, CSS, and JavaScript to provide a user-friendly interface.
- **Backend:** Implemented using Python Flask to handle application logic, bus tracking requests, ETA prediction, and notifications.
- **Database:** MongoDB is used to store student, driver, bus, and route information.

Working of the System:

The system works in the following steps:

1. The user logs in to the web application.
2. The system displays the user dashboard.

3. The driver updates the bus location.
4. The bus location is displayed on Google Maps.
5. The system predicts the bus arrival time.
6. Notifications are sent about arrivals and delays.
7. Students view bus details, ETA, and notifications.

- Real-time college bus tracking
- AI-based ETA prediction
- Simple user interface
- Smart arrival and delay notifications

Advantages:

- Reduces students' waiting time.
- Provides easy access to bus information.
- Improves transportation management.
- Helps students know bus arrivals and delays.

Applications:

- College bus tracking
- Student transportation management
- Bus arrival time monitoring
- Transport delay notifications

Table:

Feature	Traditional System	Google Maps	AI-Smart Bus System
Bus Tracking	Manual	Yes	Yes
ETA Prediction	No	Estimated	AI-based
Notifications	Manual	Limited	Yes

Implementation Details :

The backend was developed using Python Flask to handle bus tracking, ETA prediction, and notification functions. MongoDB was used to store student, driver, bus, and route details. Google Maps was integrated to display bus locations and routes.

The frontend was designed using HTML, CSS, and JavaScript to provide a simple and user-friendly interface. Machine learning techniques were used to estimate bus arrival times based on available distance and speed data.

Results and Discussion:

After testing the system, we found that the AI-Smart College Bus Tracking and Notification System provides convenient access to bus locations, routes, and estimated arrival times. The Google Maps integration helps students view bus locations, while notifications provide updates about arrivals and delays. The system also simplifies the management of students, drivers, buses, and routes.

Sign In Page & Login Page :



Create Student Account

Sri Shakthi Institute of Engineering and Technology, Coimbatore

College Name *

Sri Shakthi Institute of Engineering and Technology, Coimbatore

PERSONAL INFORMATION

Full Name * College Email *

e.g. John Doe student@srishakthi.ac.in

Phone Number * Roll Number / Register No *

9876543210 SSIT2026CSE001

ACADEMIC DETAILS

Department * Year *

Select Department Select Year

Semester * Nearest Bus Stop

Select Semester e.g. Gandhipuram or Peelamedu

SECURITY CREDENTIALS

Password * Confirm Password *

Min 6 characters Re-enter password

Complete Registration

Welcome Back

Sign in to access your real-time campus transit portal

Student Driver Admin

College Email / Roll Number

student1@srishakthi.ac.in or Roll No

Password

Enter your password

☒ Remember me [Forgot password?](#)

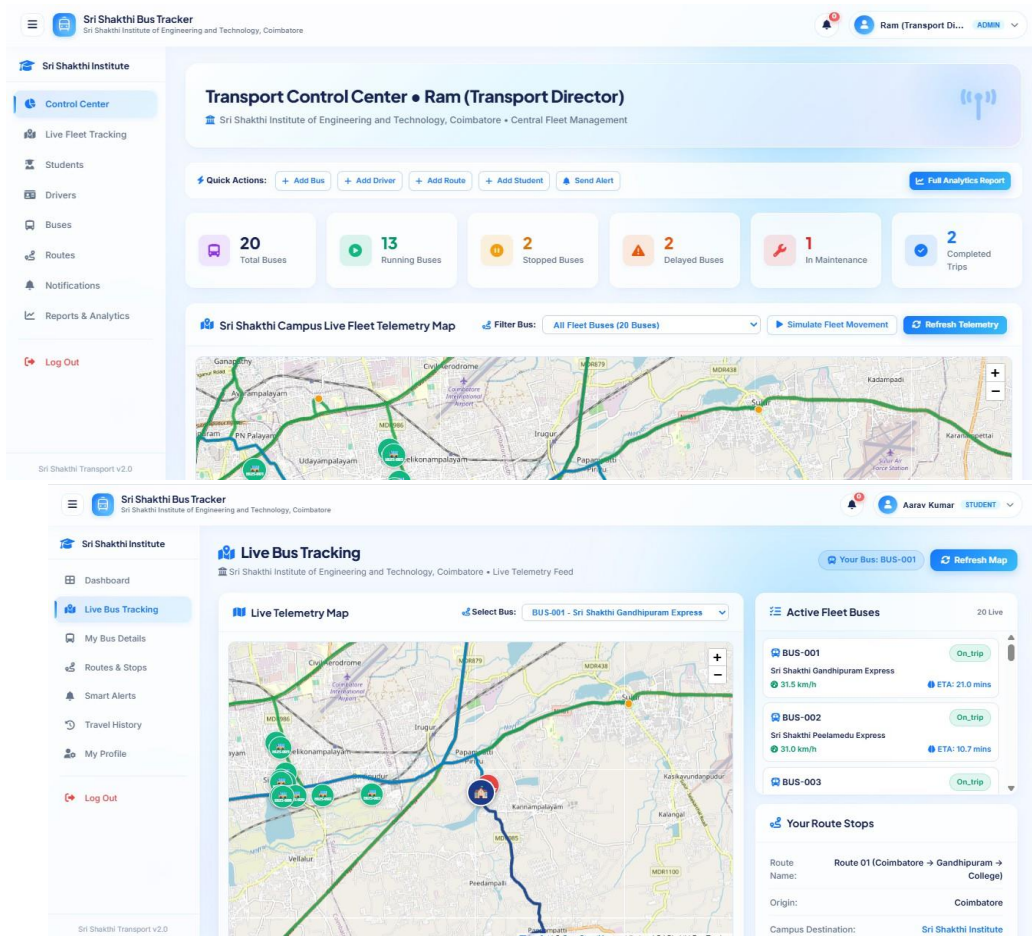
Sign In to Portal

1-CLICK DEMO LOGIN

Student Driver Admin

New student at Sri Shakthi? [Create an account](#)

Chat Page:



Database page:

```

Database Package Initialization
Provides MongoDB connection and database operations
'''
import hashlib
import time
from pymongo import MongoClient
from pymongo.errors import DuplicateKeyError
from config import get_config

def _make_id():
    """Generate a unique ID that looks like a MongoDB ObjectId (24 hex ch
    raw = f"{time.time_ns()}-{id(object())}"
    return hashlib.md5(raw.encode()).hexdigest()[:24]

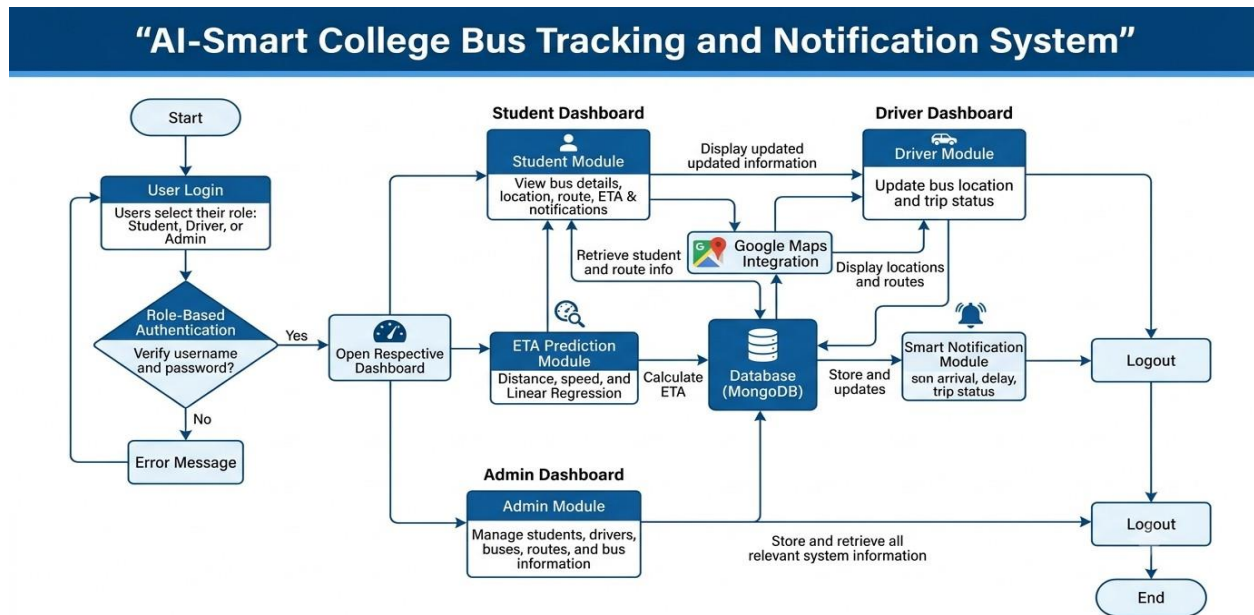
class FallbackCursor:

from datetime import datetime, timedelta
import random
from database import get_db, _make_id
from utils.helpers import hash_password, haversine_distance
from ai.eta_model import predict_eta

# Central Location: Sri Shakthi Institute of Engineering and Technology,
COLLEGE_LOCATION = {
    'name': 'Sri Shakthi Institute of Engineering and Technology, Coimbat
    'short_name': 'Sri Shakthi Institute',
    'lat': 10.9992,
    'lng': 77.0818,
    'address': 'Chinnampalayam, Coimbatore, Tamil Nadu 641062, India'
}

# Key Coimbatore Location Coordinates
COIMBATORE_LOCATIONS = {

```

Workflow Diagram:**Equations:**

The bus arrival time prediction is calculated using the following equation:

Estimated Arrival Time = Distance / Average Speed Where:

- Distance represents the remaining distance between the bus and the destination.
- Average Speed represents the average speed of the bus.
- Estimated Arrival Time (ETA) indicates the approximate time required for the bus to reach the destination.

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Conclusion:

The AI-Smart College Bus Tracking and Notification System is a useful application that helps students track college buses and view estimated arrival times. By integrating Google Maps, ETA prediction, and smart notifications, the system improves transportation convenience and communication. In the future, we plan to enhance prediction accuracy and add more advanced tracking features.

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