🌍 Tourism Footprint Analytics System (Kedah)

Albukhary International University (AIU)

Bachelor of Computer Science (Honours) — Data Science

Final Year Project (FYP)

Overview

Tourism Footprint Analytics System (Kedah) is a full-stack web platform designed to collect, analyze, and visualize real-time tourism insights across Kedah, Malaysia.

It empowers tourism boards, local vendors, and travelers to explore **stays, events, transport routes, and vendors**, supported by interactive analytics and geospatial visualization.

The project supports **sustainable tourism development** by combining data-driven intelligence with social engagement tools.

Objectives

1. Develop a centralized **tourism data platform** for Kedah state
2. Visualize and analyze tourism patterns (visitors, events, routes, stays)
3. Enable local businesses to gain visibility through integrated vendor listings
4. Promote data-informed decision-making for tourism stakeholders
5. Support sustainability through climate-conscious design and analytics
6. **Implement hybrid data architecture** for instant loading and reliability

Key Features

📊 Advanced Analytics

- **Real-time Dashboard Metrics** - Visitor statistics, engagement rates, post counts
- **Social Media Analytics** - Platform-wise engagement trends (Instagram, Facebook, Twitter)
- **Sentiment Analysis** - Tourism sentiment breakdown with visual charts
- **Trending Destinations** - Dynamic ranking of popular and hidden gem locations
- **Event Attendance Tracking** - Expected vs actual attendance with trend analysis
- **Transport Analytics** - Mode statistics and popular route tracking

Hybrid Data Architecture

- **Instant Loading** - Demo data displays immediately (zero loading time)
- **Backend Integration** - Automatic API data fetching on component mount

- **Graceful Fallback** - Shows demo data when backend unavailable
- **Error Resilience** - Try-catch error handling with state preservation
- **Presentation-Ready** - Works perfectly with or without backend connection

🗺 Geospatial Features

- **Interactive Maps** - Leaflet.js integration for location visualization
- **Nearby Search** - Find attractions, vendors, stays near specific coordinates
- **Route Mapping** - Visualize transport routes within and to/from Kedah
- **Spatial Queries** - PostGIS-powered location-based analytics

🔍 Search & Filter

- **Smart Search** - Autocomplete for vendors, stays, and transport routes
- **Multi-Filter** - Filter by price, rating, type, district, cuisine, date
- **Category Sorting** - Organize by accommodation type, event tags, transport modes
- **Date Range** - Filter events by time period (upcoming/past)

🏗 System Architecture

Hybrid Data Architecture - The system uses a dual-data approach for optimal user experience:

- **Demo Data:** Embedded in frontend components for instant loading
- **Backend API:** Django REST Framework serving real-time analytics
- **Graceful Fallback:** Components display demo data when backend is unavailable

Technology Stack

- **Frontend**: React 18.3.1 + TypeScript + Vite 5.4.21
- **UI Libraries**: Tailwind CSS + Radix UI + Recharts
- **Backend**: Django 5.2.6 + Django REST Framework 3.15.2
- **Database**: PostgreSQL (AWS RDS) / SQLite (Development)
- **Cloud Infrastructure**: AWS Elastic Beanstalk, EC2, S3, CloudFront
- **Mapping**: Leaflet.js + React-Leaflet
- **HTTP Client**: Axios for API communication
- **Future**: Celery + Redis (async processing)

⚙ Core Modules

📊 Analytics Dashboard

- **Overview Metrics** - Real-time visitor statistics, engagement rates, post counts
- **Social Media Analytics** - Platform-wise engagement trends and performance
- **Popular Destinations** - Top visited places with visitor distribution charts
- **Hidden Gems** - Least visited destinations for tourism discovery

- **Sentiment Analysis** - Tourism sentiment breakdown (positive/neutral/negative)
- **Event Attendance Trends** - Expected vs actual attendance analytics
- Hybrid data approach (demo + backend) for instant loading

Stays

- Manage and view hotels, apartments, guest houses, and homestays
- Filter by price, rating, type, district, and amenities
- Integrated with geolocation coordinates for map display
- Statistics by accommodation type

Vendors

- Local restaurants, markets, and businesses with cuisines and locations
- City-based filtering and geospatial mapping
- Search functionality with autocomplete
- Cuisine categorization

Transport

- Route analytics **within Kedah (Intra-Kedah)** and **to/from Kedah**
- Transport mode statistics (bus, taxi, rental, etc.)
- Popular routes tracking
- Monthly usage trends
- "From → To" search with autosuggestions and route classification

Events

- Upcoming and past events display
- Attendance tracking (expected and actual)
- Filterable by date, city, and tags
- Event categorization (culture, food, sports, etc.)
- Timeline visualization

📊 Data Flow Summary

Hybrid Data Architecture (November 2025)

The system implements a **dual-data strategy** for optimal reliability:

1. **Frontend Components** — React components with embedded demo data

   o Instant page load (no waiting for API)
   o useState initialization with default/demo data
   o Works offline or during backend maintenance

2. **API Integration** — Automatic backend data fetching

   o useEffect hooks fetch from Django REST API on mount
   o Conditional state update (only if backend returns data)
   o Error handling with try-catch blocks

3. **Data Storage** — PostgreSQL (AWS RDS for production)

   o Place, SocialPost, Event (with attendance fields), Stay, Vendor, Transport models
   o Spatial data support with PostGIS
   o SQLite for local development

4. **API Exposure** — Django REST Framework

   o 14 analytics endpoints
   o 6 CRUD endpoints
   o CORS-enabled for frontend communication

5. **Visualization** — Maps, charts, and dashboards

   o Recharts for analytics visualization
   o Leaflet.js for interactive maps
   o Real-time data updates when backend available

📁 Project Structure

```
tourism-analytics-dashboard/
├── frontend/                    # React + TypeScript frontend
│   ├── src/
│   │   ├── components/        # React components (8 core components)
│   │   │   ├── OverviewMetrics.tsx        # Dashboard metrics
│   │   │   ├── SocialMediaCharts.tsx      # Social engagement
│   │   │   ├── PopularDestinations.tsx    # Top/least visited
│   │   │   ├── EventsTimeline.tsx         # Events + attendance
│   │   │   ├── AccommodationStats.tsx     # Hotel analytics
│   │   │   ├── SentimentAnalysis.tsx      # Sentiment breakdown
│   │   │   ├── RestaurantVendors.tsx      # Vendor listings
│   │   │   ├── TransportAnalytics.tsx     # Transport analytics
│   │   │   └── MapView.tsx                # Interactive map
│   │   ├── data/             # Demo/fallback data files
│   │   ├── lib/              # Utility functions
│   │   └── styles/           # CSS/Tailwind styles
│   ├── package.json          # Dependencies (React 18.3.1, Vite
5.4.21)
│   └── vite.config.ts        # Vite build configuration
│
├── backend/                     # Django backend
│   ├── analytics/             # Analytics app (core)
│   │   ├── models.py          # Place, SocialPost models
│   │   ├── views_new.py       # 14 analytics API views
│   │   ├── views_crud.py      # CRUD ViewSets
│   │   ├── serializers.py     # DRF serializers
│   │   └── urls.py            # API routing (20+ endpoints)
│   ├── events/                # Events app
│   │   ├── models.py          # Event model (with attendance fields)
```

```
│       ├── views.py               # Event CRUD
│       └── migrations/            # Database migrations
│   ├── stays/                     # Accommodation app
│   ├── transport/                 # Transport app
│   ├── vendors/                   # Vendors app
│   ├── tourism_api/               # Django project settings
│   │   ├── settings.py            # Configuration
│   │   └── urls.py                # Main URL routing
│   ├── manage.py                  # Django management
│   ├── requirements.txt           # Python dependencies
│   └── db.sqlite3                 # Development database
│
├── docker-compose.yml             # Multi-container orchestration
├── ARCHITECTURE.md                # System architecture documentation
├── README.md                      # This file
└── TODO.md                        # Project tasks
```

🛠️ Build & Development

Frontend

```
cd frontend
npm install                       # Install dependencies
npm run dev                       # Development server (port 5173)
npm run build                     # Production build (outputs 737KB)
```

Backend

```
cd backend
pip install -r requirements.txt # Install dependencies
python manage.py migrate         # Run database migrations
python manage.py runserver 8001 # Development server (port 8001)
```

Database Migrations

```
# Create migration for Event attendance fields
python manage.py makemigrations events

# Apply migrations
python manage.py migrate

# Populate sample data
python populate_attendance.py
```

Deployment (AWS)

Deployed using AWS Elastic Beanstalk

- Environment: Python 3.13 / Node 20
- Service Role: `aws-elasticbeanstalk-service-role`
- EC2 Role: `aws-elasticbeanstalk-ec2-role`
- Database: PostgreSQL (RDS)
- Storage: S3 Bucket for media
- Static Hosting: CloudFront + S3 for frontend build

🖥 API Endpoints

Analytics Endpoints (14 routes)

Endpoint	Method	Description
`/api/analytics/overview-metrics/`	GET	Dashboard metrics (visitors, engagement, posts)
`/api/analytics/social-engagement/`	GET	Social media engagement trends
`/api/analytics/sentiment/summary/`	GET	Sentiment analysis summary
`/api/analytics/places/popular/`	GET	Most visited destinations
`/api/analytics/places/least-visited/`	GET	**NEW** Hidden gems/least visited places
`/api/analytics/events/attendance-trend/`	GET	**NEW** Event attendance analytics
`/api/analytics/places/list/`	GET	Complete places listing
`/api/analytics/places/trending/`	GET	Trending destinations
`/api/analytics/places/nearby/`	GET	Nearby places (geospatial)
`/api/analytics/keywords/top/`	GET	Top tourism keywords
`/api/analytics/social/metrics/`	GET	Social media metrics
`/api/analytics/social/platforms/`	GET	Platform breakdown
`/api/analytics/sentiment/categories/`	GET	Sentiment by category

CRUD Endpoints (6 routes)

Resource	Endpoint	Methods	Description
Vendors	`/api/vendors/`	GET, POST, PUT, DELETE	Restaurant/vendor management
Stays	`/api/stays/`	GET, POST, PUT, DELETE	Accommodation listings
Events	`/api/events/`	GET, POST, PUT, DELETE	Event data with attendance
Transport	`/api/transport/routes/`	GET, POST	Travel routes management
Places	`/api/places/`	GET, POST, PUT, DELETE	Tourism places (ViewSet)

Posts	/api/posts/	GET, POST, PUT, DELETE	Social media posts (ViewSet)

System Status (November 2025)

- **7/10 endpoints fully operational** (200 OK)
- ⚠ **3/10 endpoints with fallback** (vendors, sentiment, transport have demo data)
- **100% presentation-ready** (hybrid approach ensures data always displays)

🖥 Contributors

Name	Role	Profile
Amadou Oury Diallo	Backend	[GitHub](#)
Samia Hassan Haron Hamid	Frontend	—
Hasibullah Naeim	Data Analytics	—
ABU BAKAR NGAH: Sir Abu Bakar Ngah	Project Supervisor	Albukhary International University

Academic Details

- **Course:** Final Year Project (FYP)
- **Programme:** Bachelor of Computer Science (Honours) – Data Science
- **Institution:** Albukhary International University (AIU), Malaysia
- **Semester:** 2025 / Trimester 2

Contributors

Development Team

- **Amadou Oury Diallo** - Backend Developer
- **Samia Hassan Haron Hamid** - Frontend Developer
- **Hasibullah Naeim** - Data Analyst

Supervisor

- **Sir Abu Bakar Ngah** - Project Supervisor

◈ Future Enhancements

Completed (November 2025)

- **Tourism Analytics Dashboard** with charts and KPIs
- **Hybrid data architecture** for instant loading and fallback
- **Least visited destinations** analytics
- **Event attendance tracking** and trend analysis
- **Social media engagement** analytics
- **Sentiment analysis** visualization

Planned Features

- Fix 3 backend API endpoints (vendors, sentiment, transport)
- Integrate **social media sentiment analysis** (TripAdvisor, Facebook, Instagram)
- Enable **real-time map clustering** of vendors and events
- Provide **AI-powered recommendation engine** for stays and attractions
- Add **admin statistics dashboard** (visits, revenue, user insights)
- Implement **caching layer** (Redis) for performance
- Add **WebSocket support** for real-time analytics
- Mobile app development (React Native)
- Predictive analytics with machine learning

License

This project is for academic and research purposes under Albukhary International University (AIU).

"Turning data into sustainable tourism insights for a better Kedah."