Product Requirements Document (PRD)

Project: AI-Assisted Emergency Dispatch – Map Prototype (Ingolstadt)
Type: Interactive UX / Concept Prototype
Audience: Developers, Designers, Research Evaluators
Goal: Demonstrate how an AI-assisted dispatch interface could support routing decisions under real-world constraints (traffic, congestion), without automating decisions.

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1. Problem Statement

Emergency dispatchers rely heavily on experience and situational awareness when assigning vehicles to incidents.
Current systems often:

- Do not visualize **real-time traffic impact** clearly
- Do not make routing consequences **immediately visible**
- Require dispatchers to mentally simulate travel times and congestion
- Offer little transparency into why a route may be delayed

This prototype explores how a **map-based, transparent routing visualization** could support — not replace — human decision-making.

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2. Objectives

Primary Objective

Create a **single-screen interactive map prototype** that simulates emergency dispatch routing with traffic awareness.

Secondary Objectives

- Support **trust calibration** by visualizing route quality instead of making opaque recommendations
- Reduce cognitive load through **immediate visual feedback**
- Enable exploratory interaction for research, demos, and portfolio use

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3. Scope

In Scope (MVP)

- One interactive map screen

- Real map of **Ingolstadt, Germany**
- Simulated emergency vehicles with random positions
- Simulated incident location
- Click-based route calculation
- Traffic-aware route visualization

Out of Scope (for now)

- Real dispatch logic or optimization
- Backend systems
- Authentication
- Multi-screen workflows
- Legal or operational deployment

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4. User Persona

Primary User:
Emergency Dispatcher (Fire / EMS)

Characteristics:

- Works under time pressure
- High responsibility, high accountability
- Strong reliance on experience (“gut feeling”)
- Skeptical of automation, values transparency and control

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5. User Flow

1. User opens the prototype
2. A map of Ingolstadt is displayed
3. Several emergency vehicles are visible on the map
4. User clicks **“Simulate Incident”**
5. An incident location appears on the map
6. User clicks on a vehicle
7. A route from vehicle → incident is calculated and displayed

8. Route segments visualize traffic conditions:
    - Blue = free flow
    - Orange = slow traffic
    - Red = congestion
9. User can click another vehicle to compare routes

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6. Functional Requirements

FR-1: Map Display

- Display a real, interactive map centered on Ingolstadt
- Pan & zoom enabled
- Clean, minimal UI (dispatch-friendly)

Suggested tools:
Mapbox GL JS / Google Maps SDK / Leaflet

FR-2: Vehicle Simulation

- Display multiple emergency vehicles on the map
- Vehicle types can be generic (e.g. “RTW”, “Fire Engine”)
- Initial positions are **randomized within Ingolstadt**
- Vehicles are clickable

Visual Requirements:

- Clear icons
- Always visible on the map
- No clutter

FR-3: Incident Simulation

- A button labeled **“Simulate Incident”**
- On click:
    - Generate a random incident location within Ingolstadt
    - Place an incident marker on the map

- Only one active incident at a time (MVP)

FR-4: Route Calculation

- When a vehicle is clicked:
    - Calculate a route from the vehicle to the incident
- Route should follow real road geometry
- Route is drawn on the map immediately

Technical Options:

- Mapbox Directions API
- Google Directions API
- OpenRouteService

FR-5: Traffic-Aware Visualization

- Route is segmented and color-coded:
    - **Blue:** normal traffic
    - **Orange:** slow traffic
    - **Red:** heavy congestion / traffic jam
- Traffic data can be:
    - Real (preferred, via API)
    - Mocked / simulated (acceptable for prototype)

Key Requirement:

Traffic impact must be **visually understandable at a glance**, not hidden in numbers.

FR-6: Comparison & Override (Implicit)

- User can click different vehicles
- Each click recalculates and redraws the route
- No automatic “best vehicle” is chosen
- The system **shows**, the human **decides**

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7. Non-Functional Requirements

Usability

- One-screen only
- No modal overload
- Interaction must be understandable without explanation

Performance

- Route calculation < 1–2 seconds (perceived)
- Smooth map interactions

Transparency

- No black-box decision-making
- Visual explanation instead of textual justification

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8. Trust & Ethics Design Principles

This prototype explicitly follows **trustworthy AI principles**:

- **Human-in-the-loop:** No automatic dispatch decisions
- **Explainability:** Traffic impact is visual, not abstract
- **Control:** Dispatcher initiates every action
- **Resilience:** Prototype does not assume perfect data
- **Support, not replacement:** The system augments situational awareness

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9. Success Criteria

The prototype is successful if:

- Users immediately understand what is happening on the map
- Traffic influence on routing is obvious without explanation
- Users naturally compare vehicles instead of accepting a “recommended” one
- The interface feels supportive, not commanding

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10. Optional Enhancements (Nice-to-Have)

- ETA display per route

- Toggle: “Traffic on / off”
- Animated vehicle movement
- Time-of-day traffic simulation
- Tooltip explaining *why* a segment is red (e.g. “rush hour”)

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11. Tech Stack Suggestions (Optional)

- **Frontend:** React / Next.js
- **Map:** Mapbox GL JS
- **Routing:** Mapbox Directions API
- **Traffic:** Mapbox Traffic or Google Traffic
- **State:** Local state only (no backend)
