IDEA TITLE

Smart Traffic Signal Preemption for Ambulances using IoT + GPS

Problem: Ambulances delayed at traffic junctions → critical risk for patients.

Solution: Equip ambulances with IoT + GPS → send live location to central server.

Server checks geofences (200m radius) around each signal.

If ambulance is approaching → auto-switch signal to GREEN.

Once ambulance passes → system restores normal cycle.

Unique: Proactive, automated, scalable, integrates with smart city ITS.

TECHNICAL APPROACH

Technologies Used:
- IoT Devices: GPS + 4G/5G module
- Cloud Server: REST API / MQTT protocols
- Geofencing: Haversine formula / Google Maps API
- Traffic Signal Hardware: Raspberry Pi / Arduino + relays

Implementation Flow:
1. Ambulance IoT device → sends GPS location to server.
2. Server checks geofence of traffic signals.
3. If inside → server sends command to signal controller.
4. Traffic light turns GREEN for ambulance route.
5. After exit → system restores normal cycle.

FEASIBILITY AND VIABILITY

- Techinically feasible with current IOT+GPS+Cloud tech.
- Low-costhardware:Raspberry Pi/Arduino+GPS module.
- Easily scalable across city once geofences mapped.
- Challenges:Network latency,IOT device failure,coordination with traffic dept.
- Mitigation:5G/edge computing,backup comm protocols,phased rollout.

IMPACT AND BENEFITS

<u>Life-saving:</u> Faster ambulance movement → improved survival rate.
<u>Social:</u> Reliable healthcare response.
<u>Economic:</u> Saves fuel & reduces traffic delay.
<u>Environmental:</u> Reduced vehicle idling → lower emissions.
<u>Operational:</u> Minimizes manual intervention by police.

RESEARCH AND REFERENCES

- Intelligent Traffic System(ITS) research
- Case studies on GPS-based emergency vehicle prioritization
- IOT + Geofencing applications in smart cities.
- Google maps API,Harvesine formula.
- Communication protocols(MQTT,REST API).