SMART TRACK SYSTEM FOR VEHICLES

EMBEDDED SYSTEMS THEORY

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DELIVERABLES :

1. Uniqueness/Novelty

The proposed system integrates real-time vehicle diagnostics with GPS tracking, addressing gaps in traditional systems that focus solely on location monitoring. By combining OBD-II diagnostics (e.g., engine temperature, battery voltage) with predictive maintenance, it enables proactive detection of issues like overheating (P0118) or low voltage (P0562).

Key innovations include:

- Hybrid Alerts: Local (LED/buzzer) and remote (SMS/cloud) notifications.
- IoT Scalability: Fleet-wide monitoring and predictive analytics via cloud platforms.
- Cost Efficiency: ESP32 replaces Arduino + multiple modules, reducing costs by ~50%.

Sensor & Actuator Justification

1.DS18B20 Temperature Sensor

1. Purpose: Monitors engine coolant temperature (-55°C to +125°C).
2. Justification: High accuracy and reliability, with a simple 1-Wire interface for seamless integration with ESP32. Essential for detecting overheating (DTC P0118).

2.Potentiometer

1. Purpose: Simulates battery voltage (0-3.3V).
2. Justification: Cost-effective testing tool for simulating real-world battery conditions without direct access to a vehicle's ECU.

3.NEO-6M GPS Module

1. Purpose: Tracks vehicle location in real-time with 2.5m accuracy.
2. Justification: Industry-standard module with low power consumption, ensuring precise location tracking for fleet management and theft prevention.

4.SIM800L GSM Module

1. Purpose: Sends SMS alerts during critical conditions (e.g., overheating or low voltage).
2. Justification: Affordable and globally compatible communication module, ideal for remote notifications in areas without internet coverage.

5.16×2 LCD (I2C Interface)

1. Purpose: Displays real-time diagnostics, such as RPM, coolant temperature, battery voltage, and DTCs.
2. Justification: Low-cost display option providing immediate feedback to drivers about vehicle health metrics.

6.LED and Buzzer

1. Purpose: Visual (LED) and audible (buzzer) alerts for critical conditions like overheating or low voltage.
2. Justification: Ensures immediate driver awareness of emergencies, enabling timely corrective actions to prevent damage or accidents.

ALTERNATIVE SOLUTION

- A RASPBERRY PI-BASED SYSTEM WITH A 4G LTE HAT FOR FASTER COMMUNICATION, WIRELESS OBD-II INTEGRATION, AND AI-POWERED PREDICTIVE MAINTENANCE COULD REPLACE ESP32, OFFERING ADVANCED ANALYTICS BUT AT A HIGHER COST.

PRODUCT PITCH :

IMAGINE REDUCING FLEET MAINTENANCE COSTS BY 45% AND PREVENTING BREAKDOWNS BEFORE THEY HAPPEN! SMARTTRACK COMBINES REAL-TIME ENGINE DIAGNOSTICS WITH GPS TRACKING TO DELIVER ACTIONABLE INSIGHTS INTO VEHICLE HEALTH AND LOCATION. WITH IOT INTEGRATION, FLEET MANAGERS CAN OPTIMIZE ROUTES, REDUCE IDLE TIME, AND EXTEND VEHICLE LIFESPAN—ALL FROM A CENTRALIZED DASHBOARD. SMARTTRACK IS COST-EFFECTIVE, SCALABLE, AND DESIGNED TO ENHANCE SAFETY AND OPERATIONAL EFFICIENCY FOR MODERN FLEETS.

PROMOTIONAL LINE: "DRIVE SMARTER, MAINTAIN BETTER: REAL-TIME VEHICLE HEALTH AND LOCATION INSIGHTS."