BYTE FORCE

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Ev ision – Smarter Diagnostics for Smarter Mobility

RED HOUSE | 10

PROBLEM STATEMENT & OBJECTIVE

- Electric Vehicle Diagnostic Tool(House: RED; Problem Statement No.:10)

- The aim of this project is to design a **real-time, low-cost EV diagnostic system** that monitors voltage, current, temperature, and driving behavior, and then **alerts about faults, unsafe driving, or battery health issues**. This ensures **driver safety, longer battery life, and reliable EV performance.**

❑ WHY THIS PROBLEM MATTERS?

- EVs are growing fast, but **users face battery failures, charging issues** without warning which leads to accidents.
- **Driving style impacts battery and motor health**, yet drivers get no real-time feedback.
- **Mechanics depend on costly diagnostic tools**, making quick, affordable service difficult.
- **Fleet owners and drivers want simple, low-cost, real-time monitoring** to prevent breakdowns and extend battery life.
- A **portable EV diagnostic tool** bridges this gap, improving safety, reliability, and trust in EVs.

❖Why it Matters?

- A low-cost diagnostic tool bridges the gap between **complex EV systems** and **everyday users**.
- It helps in **preventive maintenance**, avoids sudden breakdowns, and builds **trust in EV technology**.

THE IDEA!

- **Battery Health Monitoring by Cycle:** Tracks battery condition based on charge–discharge cycles for accurate diagnostics.

- **Humidity Sensor Integration:** Monitors environmental humidity to prevent moisture-related battery issues.

- **No Miniature Circuits Used:** Avoids delicate circuits that cannot easily get damaged, increasing system reliability.

- **Smart Alerts & Predictions:** Reduces false alarms and predicts maintenance needs using real-time and historical data.

- **User-Friendly Interface:** Provides clear, actionable insights via a display.

- **Unique Advantage:** Combines **cycle-based battery monitoring** and **environmental sensing** safely, unlike conventional EV diagnostic tools.

Due to this Battery Health Monitoring, there is lot more of reduction in E-waste.

WHAT MAKES OUR SYSTEM USEFUL OR UNIQUE

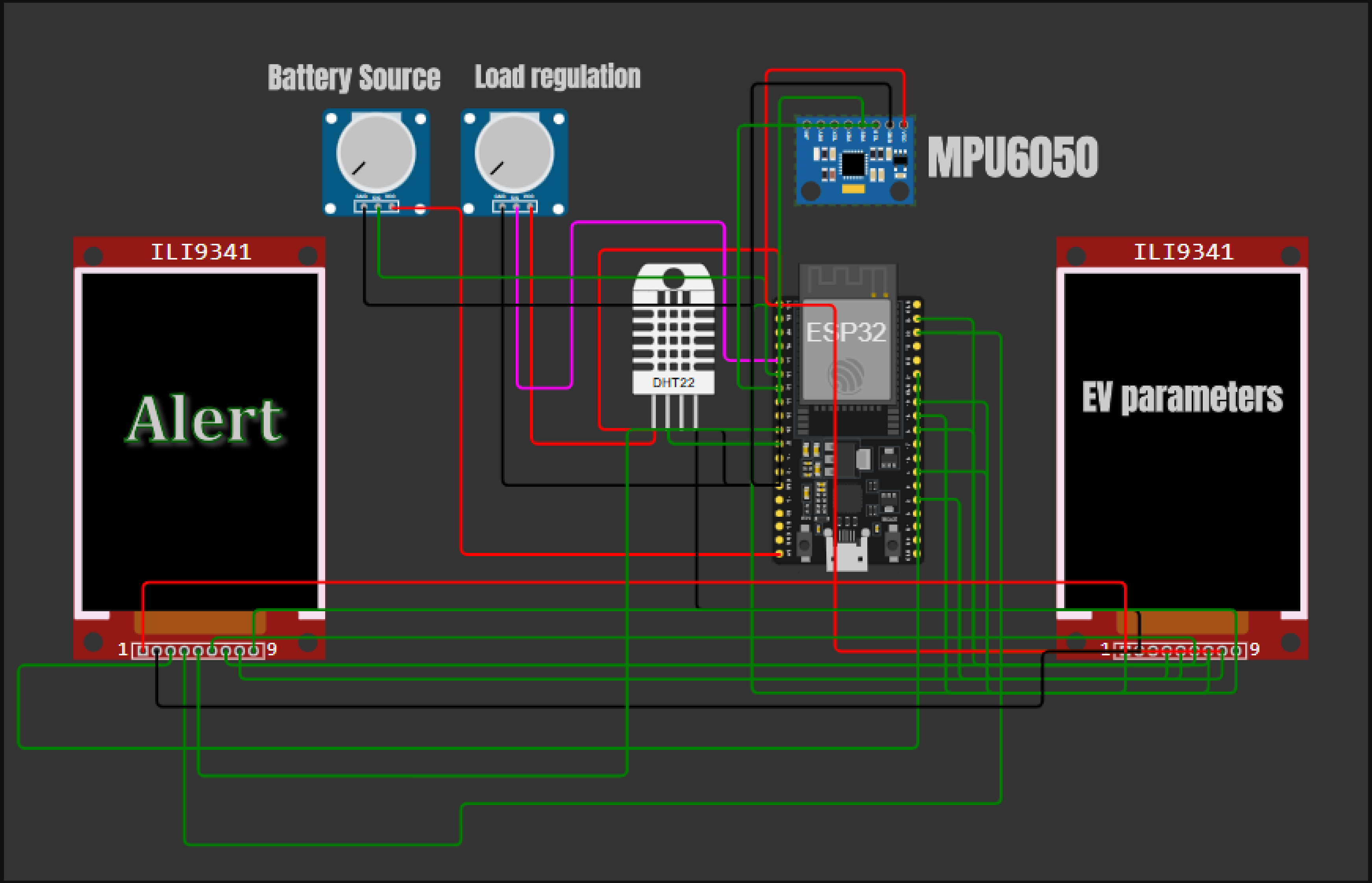
Accurate Battery Health: Cycle-based monitoring gives precise insights, not just random readings.

Prevents Damage: Humidity sensing reduces risk of moisture-related failures.

Higher Reliability: No miniature circuits → more durable and less prone to failure.

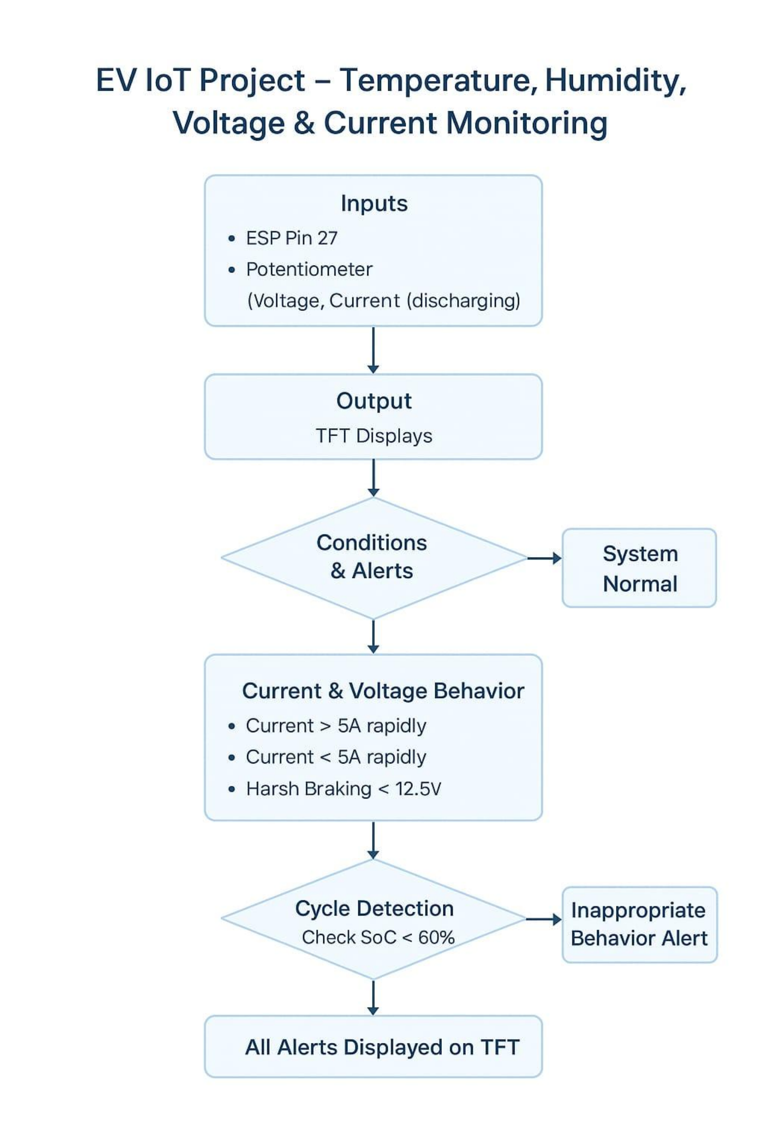
User Convenience: Easy-to-read interface saves time and improves decision-making.
Cost Saving

THE CIRCUIT DIAGRAM



Wiring Up

FLOWCHART



How It Works

TECHNOLOGY STACK

- Hardware:

1. ESP32
2. DHT22
3. 2 ILI9341(TFT DISPLAY):

   TFT1 → shows real-time parameters (V, A, SOC, Temp, Humidity, Battery Cycles, Health).

   TFT2 → shows **alerts only** (low voltage, overheating, high humidity).

4.*POTENTIOMETER(2)*:ONE USED FOR VOLTAGE SOURCE AND OTHER FOR DEMONSTRATION PURPOSE.

- Software:

1. WOKWI SIMULATOR
2. ARDUINO IDE

CHALLENGES & SOLUTIONS

CHALLENGES

1.**Basic sensors** (potentiometers, DHT22, ESP32 ADC):Limited accuracy, cannot capture real EV battery behavior. Low cost , need for calibration for modern EV system

2.**No remote monitoring:**Data only on TFT, no cloud or app. Increases cost due to modules & connectivity.

3.**EEPROM logging**:Limited write cycles, small memory. SD card module adds slight extra cost.

4.**Voltage-based SOC estimation:**Simple linear mapping is inaccurate in real EVs. Requires additional circuitry → medium cost.

5.**Scalability to real EV battery packs:** Prototype monitors single source → not suitable for multi-cell packs. Higher cost (BMS chips).

SOLUTIONS

1. Use **dedicated current/voltage sensors (INA219, ACS712)** and better temp sensors (thermistor/DS18B20).
2. Add **WiFi (MQTT) / GSM for alerts.**
3. Use **FRAM / SD card** for data history for battery usage pattern monitoring to improvements.
4. Add **Coulomb counting / BMS algorithms.**
5. Add **multi-cell monitor ICs / CAN bus.**

REFERENCES & PROJECT LINKS

- References:

- **Roy, P. K., Shahjalal, M., Shams, T., Fly, A., & Stoyanov, S. (2023).**
- Huhman, B. M. (2017).
- Pech, M., Vrchota, J., & Bednář, J. (2021).
- Bourechak, A., Zedadra, O., Kouahla, M. N., & Guerrieri, A. (2023).
- Duan, Z., Zhang, L., Feng, L., Yu, S., Jiang, Z., Xu, X., & Hong, J. (2021).

- Project Links:
- GitHub repo : https://github.com/Suryagnik414/evision-ev-diagnostic-tool
- Prototype : https://wokwi.com/projects/440894629608796161
- Demo video : shared on github