

AI-ENHANCED BATTERY MANAGEMENT SYSTEM

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PROBLEM ANALYSIS

Power Management in robot(basketball playing robot)

- ▶ Problem: High power consumption by motors and actuators in basketball-playing robots leads to rapid battery depletion and unpredictable runtime.
- ▶ Impact: Frequent recharging disrupts operation; lack of precise battery monitoring risks system failure; static power management limits efficiency.
- ▶ Challenges: No system to monitor current rate, discharge intensity, or predict runtime accurately; commercial BMS solutions are costly (>\$100) and lack adaptive control.
- ▶ Need: A low-cost, AI-enhanced embedded system to monitor current, voltage, discharge rate, predict runtime, and dynamically control power delivery.

SOLUTION

AI-Enhanced Battery Management System

Concept:

An Arduino and Raspberry Pi-based BMS with an AI model to monitor current, voltage, discharge rate, predict runtime, and optimize power allocation for the robot.

Implementation:

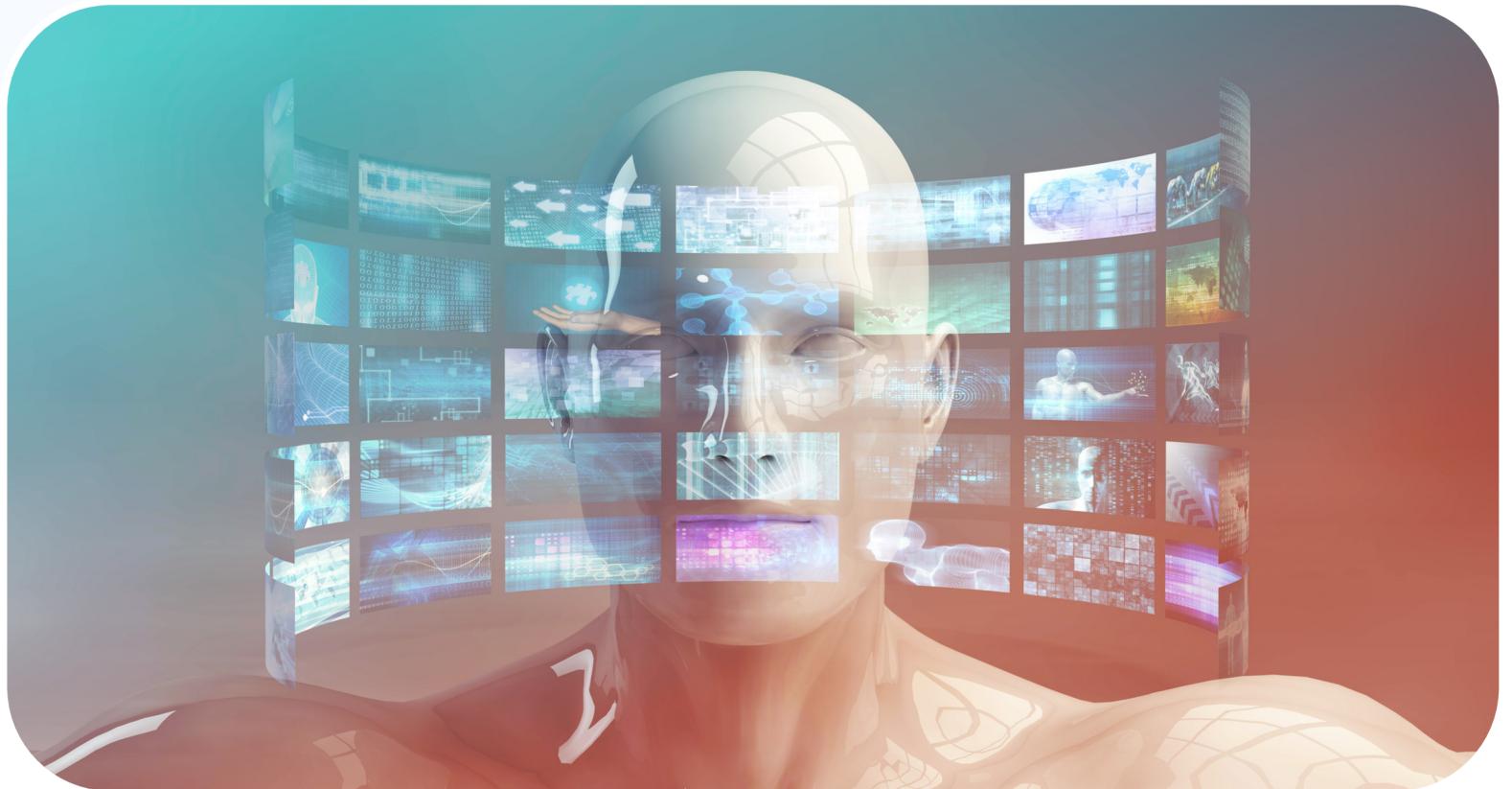
- ▶ Arduino Mega reads INA219 (voltage/current) and ACS712 (high-current) data; sends to Raspberry Pi via serial communication.
- ▶ Raspberry Pi runs a pre-trained linear regression model (using scikit-learn in Python) to predict remaining runtime based on historical current, voltage, and robot activity data stored on SD card.
- ▶ Model dynamically adjusts relay to prioritize power to critical components (e.g., shooting motor) when battery is low (<20%); OLED displays real-time data and predictions.
- ▶ Optional: Wi-Fi on Raspberry Pi sends alerts to a smartphone app (built with MIT App Inventor, free) for remote monitoring.



IMPACT AND BENEFITS

- AI improves runtime prediction accuracy by 15-20% over static methods; extends battery life via adaptive power control.
- Easy to integrate.
- Make decisions before the accidents.
- Optimal power distribution
- Sustainable development by reusing the system.
- Can be applied not only to robots but also more systems.
- Can get ideas to make decisions

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THANK YOU

