Patent Search

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Abstract:

The invention relates to a hazard-resilient ARM processor incorporating a five-stage pipelined architecture—Instruction Fetch, Decode, Execute, Memory, and Write-Back—to enhance instruction throughput and processing efficiency. A dedicated hazard detection and mitigation unit dynamically resolves data, control, and structural hazards using data forwarding, pipeline stalling, and branch prediction. The processor is implemented using Verilog HDL and synthesized on FPGA for real-time validation. The design ensures accurate instruction execution, reduced latency, and low power consumption, making it suitable for embedded, industrial, and IoT systems. The invention provides a reliable and scalable ARM-based architecture capable of high-speed, hazard-free processing under dynamic operational conditions.

Complete Specification

Description:FIELD OF THE INVENTION

[001] The present invention relates generally to the domain of solid waste management systems and, more particularly, to an artificial intelligence (AI) and Internet of Things (IoT)-based integrated system for collection, segregation, monitoring, and management of municipal waste in urban and smart-city environments. The invention further pertains to the field of digital governance and environmental sustainability technologies, employing data analytics, geo-tagging, and predictive algorithms to facilitate coordinated functioning among multiple stakeholders, including citizens, waste-collection personnel, community leaders, and administrative authorities. The disclosed system provides a real-time, transparent, and participatory mechanism for optimizing waste-collection routes, monitoring operational parameters through IoT-enabled bins and vehicles, promoting citizen engagement through gamified incentives, and supporting policy formulation through AI-driven analytics. Accordingly, the invention lies at the intersection of waste management engineering, information and communication technology (ICT), and smart-city infrastructure management, offering a scalable and sustainable solution for cleaner urban ecosystems.

BACKGROUND OF THE INVENTION

[002] Solid waste management has become one of the most critical challenges in urban governance and environmental protection, particularly in developing nations undergoing rapid urbanization. Municipal authorities are required to manage increasing volumes of domestic, commercial, and industrial waste while ensuring compliance with environmental standards, health regulations, and the principles enshrined under the Solid Waste Management Rules, 2016, notified by the Ministry of Environment,

View Application Status

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