

# MulticoreWare Deploys AMD Ryzen™ Embedded Processors for AI Retail Checkout Solution

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*Solution aims to help retailers enhance customer satisfaction and reduce theft.*

## INTRODUCTION

MulticoreWare, Inc., has developed an advanced AI-powered smart checkout solution, RetailSentry AI, for retail applications powered by the AMD Ryzen™ Embedded 8000 Series processors. This intelligent point-of-sale (POS) system leverages multiple AI models running simultaneously across the processor's integrated CPU, GPU, and AMD XDNA™ Neural Processing Unit (NPU) architecture. When a product is presented, the system captures its image, scans its barcode, and employs computer vision-based object detection to verify the product against the store's database before adding it to the customer's cart. Based on what the customer has purchased, the system is also capable of recommending complementary products that may interest the user thereby increasing store revenue. What sets this solution apart is its integrated shoplifting detection capability, which continuously monitors customer behavior for suspicious activities using AI algorithms. Upon detecting potential theft, the system generates instant LLM-driven alerts to notify nearby store staff in real-time.

## CHALLENGE

Traditional checkout systems often require significant staff intervention when users encounter difficulties. And with inefficient or poorly designed systems, retailers can also face high theft rates and miss opportunities to recommend complementary products through data analysis.

"We wanted to build a solution that solved three common problems at retail self-checkout lanes and grab-and-go food stations," said Manish Rawat, Director of Business Development at MulticoreWare. "We needed the system to be able to understand which product is being checked out, make sure that the visual recognition matches the barcode, and detect theft, with the ability to alert store clerks in real time."

During the self-checkout process, the scanned product name and image are collected by cameras using object detection and compared with information on the product's barcode. "We needed a processor that could handle our multisensory approach, integrating vision sensing with barcode data, and allowing us to run inference on multiple AI models," Rawat said.

To accomplish this, MCW chose an AMD Ryzen Embedded processor capable of carrying out all these tasks on a single chip that integrates a CPU, GPU and NPU, versus multiple chips from other vendors.

## SOLUTION

MulticoreWare's checkout solution is built on computer-vision based object detection and similarity matching with barcode verification.

## INDUSTRY

Automated POS retail application.

## CHALLENGES

Multi-sensor input data processing, including integration of image data processing and barcode data, and inference on multiple AI models, including CNN, LSTM and LLM models.

## SOLUTION

POS checkout solution built on computer-vision based object detection and similarity matching with barcode verification. In addition, for fraud and anomaly detection, the system uses AI to identify suspicious behaviors.

## RESULTS

AMD Ryzen Embedded processors enabled MulticoreWare, Inc. to deploy the latest AI technology, and deliver a seamless, hassle-free shopping experience by enabling fast and accurate product scanning and verification. At the same time the solution helps retailers reduce fraud and theft, and increasing business revenue potential by enabling product upselling based on the customers' purchases in the past.

## AMD TECHNOLOGY AT A GLANCE

AMD Ryzen™ Embedded 8845HS processor.

## TECHNOLOGY PARTNER

MulticoreWare, Inc.,

Product identification occurs by calculating the similarity between detected products and reference images in a database. The barcode scanner reads the product barcodes for quick and precise checkout, and AI object detection cross-verifies the scanned item to detect mismatches or incorrect scans. If a barcode is swapped with a cheaper item, the camera detects the discrepancy and triggers an alert. For fraud and anomaly detection, the system uses AI to identify suspicious behaviors like missed scans, barcode tampering, or item swapping. The components involved in the checkout system include a Yolo algorithm-based object-detection model trained on custom data to detect the products; a similarity-checking module that compares the detected product against the database by extracting features using a Resnet-based model; an anomaly / shoplifting detection module that monitors the shop for suspicious activities using a CNN-LSTM based model; and an LLM module, that generates a response using the LLAMA2 large language model.

To interact with these modules, the system has a centralized graphical user interface (GUI) for monitoring, managing, and analyzing real-time and historical product and surveillance data. The Dashboard includes a live camera feed of the product-scanning area; a real-time product barcode scanning system that presents comprehensive information about each product (including name, price, description, brand, and other key attributes); and cart details that allow users to add or remove products and displays real-time totals. This dashboard view also contains important performance metrics including CPU and memory utilization. The system also includes a real-time camera view that instantly displays flagged shoplifting events, and an anomaly archive that systematically catalogs and stores all detected incidents for review.

## RESULT

Managing intensive and diverse AI workloads while ensuring real-time, immersive responses with an interactive graphical interface presents a significant challenge for embedded devices. AMD Ryzen™ Embedded 8000 Series processors provide powerful x86 CPU compute capabilities with up to eight “Zen 4” cores (16 threads) and include integrated AMD Radeon™ graphics that optimize visual processing and multimedia performance. In addition, the AMD Ryzen™ Embedded 8845HS processor delivers up to 20 lanes of on-chip PCIe® Gen4 to provide ample I/O flexibility for processing information.

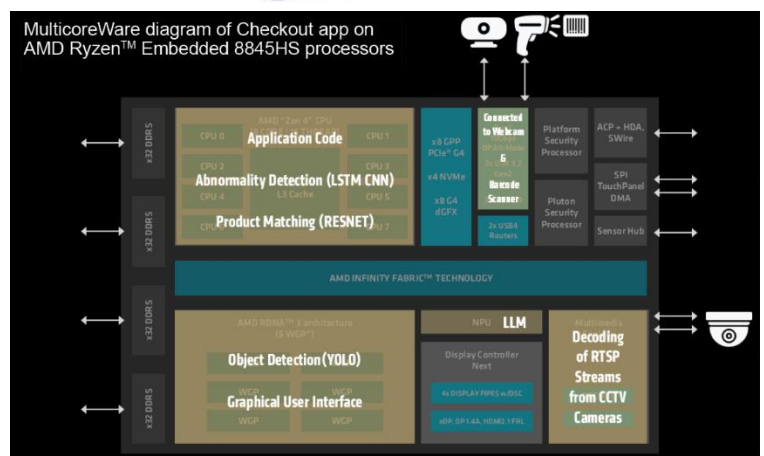
The object detection is carried out using a Yolo algorithm-based model loaded onto the AMD processor that has been trained on custom data to detect a scanned product. An image of the detected product is cropped and saved for similarity check. The similarity check uses a ResNet architecture-based model to extract feature embeddings from a detected product image. These embeddings are compared against the reference embeddings stored in a database to find the similarity between them.

Detecting suspicious activities in store camera footage involves using a CNN-LSTM based classification model to analyze video frames and identify unusual behaviors. This is also carried out by the AMD Ryzen Embedded processor with its on-board XDNA™ architecture—a new capability for Ryzen Embedded x86 solutions that enables fast and smooth AI inferencing and decision making at the industrial edge for various AI models.

The system processes video streams to classify activities as normal or suspicious based on predefined categories. When a suspicious activity is identified, the system triggers a process to save the specific segment for review. The Transformer-based architecture acts as the image encoder, generating embeddings that are compared to the embeddings generated from descriptive text labels. The comparison is done using cosine similarity which measures how close the image and text embeddings are in the feature space.

A Llama2 large language model is used for generating contextual notifications in the system. The model is employed for two key tasks: creating anomaly detection alerts and displaying facts about products added to the cart that enhance the user experience.

**“AMD Ryzen Embedded processors help us deploy the latest AI technology to deliver a seamless, hassle-free shopping experience by enabling fast and accurate product scanning and verification -- all while helping retailers reduce fraud and theft,” Rawat said. “We believe this core technology can serve as a foundation for creating a more transformative and interactive, in-person shopping experience in the future.”**



#### ABOUT MulticoreWare, Inc.

MulticoreWare is a global technology company offering heterogeneous hardware, software, and engineering services to a variety of industries. The company delivers software IP solutions and engineering services for a wide range of applications, including automotive, defense, medical imaging, retail, industrial, robotics, and smart city. More information is available at <https://www.multicorewareinc.com>.

#### ABOUT AMD

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