

# Qkart

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→ Introduction

Objectives

Literature Survey

Proposed Approach

Project Outcome

# "Revolutionizing Grocery Shopping with Smart Automation"

A seamless, queue-free experience

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## OBJECTIVES

# Why is QKart needed?

Long queues = Frustrated customers & lost revenue"

QKart aims to change that with an intelligent, automated checkout system.

①

### Loss of Customer

Develop a functional AI-powered smart cart prototype with <150 ms detection time.

②

### Overused System

Achieve dual-verification using vision + weight sensors to minimize errors.

③

### Cost of Business

Integrate with a secure, scalable backend for real-time billing and inventory updates.

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# Literature Survey

## Our research findings

1. **YOLO-based retail object detection** research shows that real-time inference on edge devices is possible with optimized models, but performance can be affected by lighting and occlusion.
2. **Hybrid vision + weight** sensing approaches from prior studies improve fraud prevention and **detection accuracy**, though they require precise calibration.
3. **Cloud-based smart cart** prototypes achieve high accuracy but suffer from latency and connectivity issues, making edge computing a better alternative for **speed and reliability**.

## Research Gaps

### The Issues in the market

- Existing systems rely heavily on cloud computing, causing latency in detection.
- Many lack robust fraud prevention mechanisms for item swapping or misplacement.
- Limited focus on scalable backend integration for inventory and payment management.

“ QKart introduces an automated checkout system to eliminate delays and enhance customer experience.

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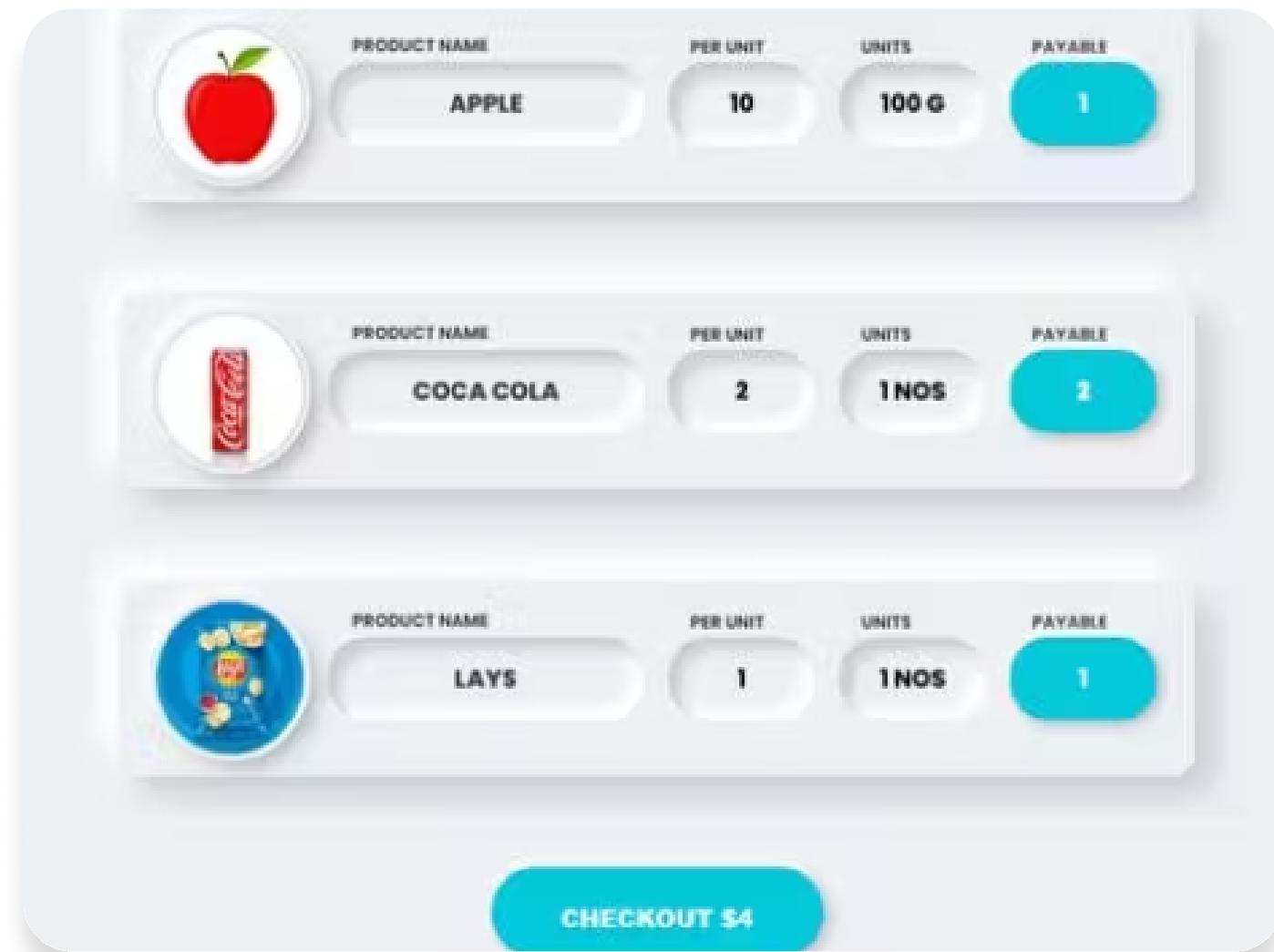
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# Hardware

- ✓ Processing Unit – Raspberry Pi
- ✓ Camera Module – For real-time object detection.
- ✓ Weight Sensors (HX711) – Weight verification.
- ✓ LCD Display – Shows billing details
- ✓ Battery Unit – Ensures portability



# Software

- YOLO – Object detection for automatic item recognition.
- OpenCV & Python – Image processing & Model Training.
- Firebase – Database for billing & inventory.
- Flask API – User Interface.

# Dataset Collection & Model Training

## ① Image Collection & Annotation

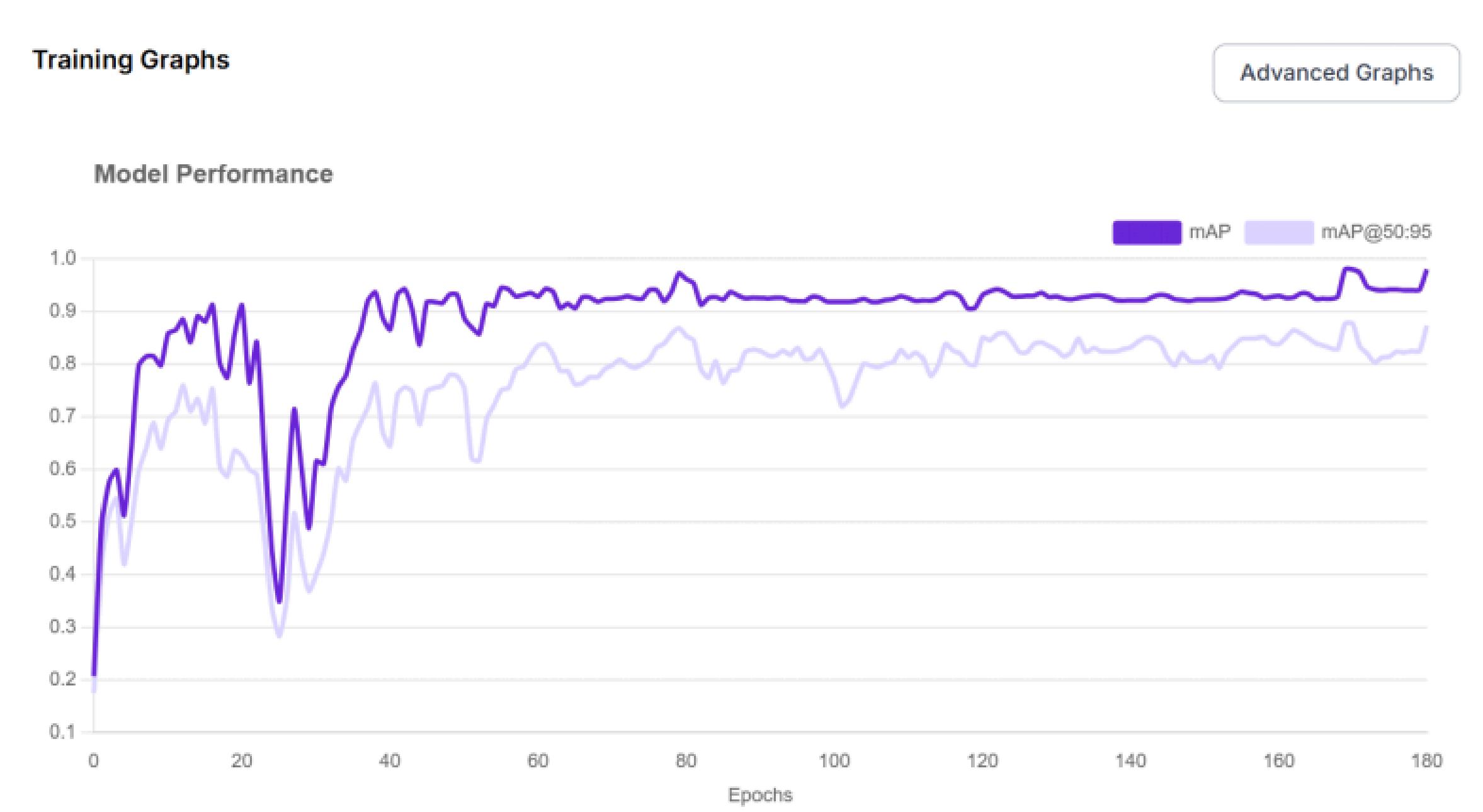
Capturing grocery items from multiple angles and labeling them using YOLO format.

## ② Preprocessing & Training

Enhancing image quality, applying augmentation, and fine-tuning the YOLO model.

## ③ Evaluation & Optimization

Measuring accuracy, recall, and inference speed to refine the model.



# Prospective Learning of the Project

- End-to-end system integration of hardware, AI, and backend systems.
- Edge AI deployment and optimization for resource-constrained devices.
- Backend API design and frontend UI/UX development.
- Agile project management and iterative testing in real-world conditions.

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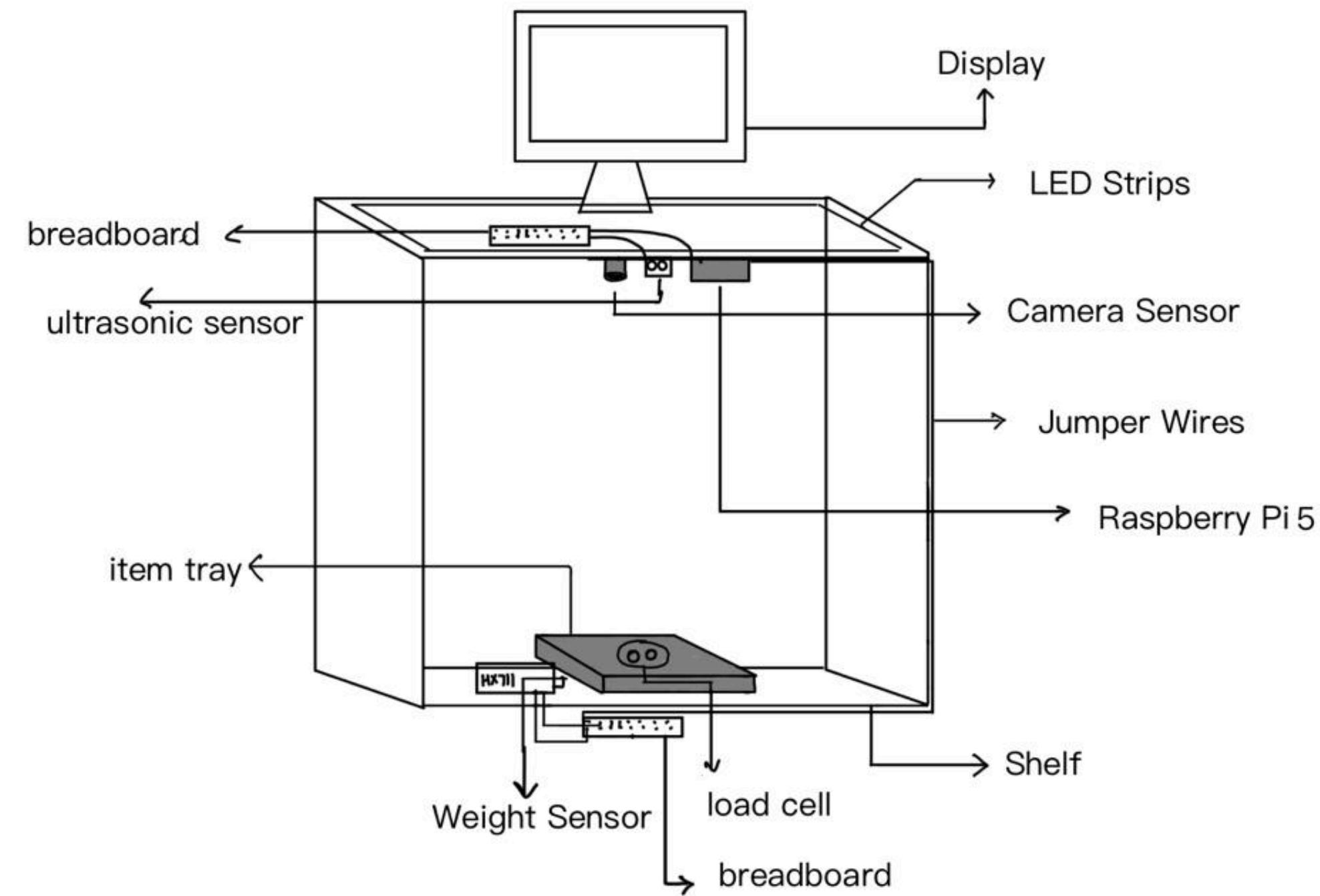
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# Our Final Product

A seamless, AI-powered checkout system  
for a frictionless shopping experience."



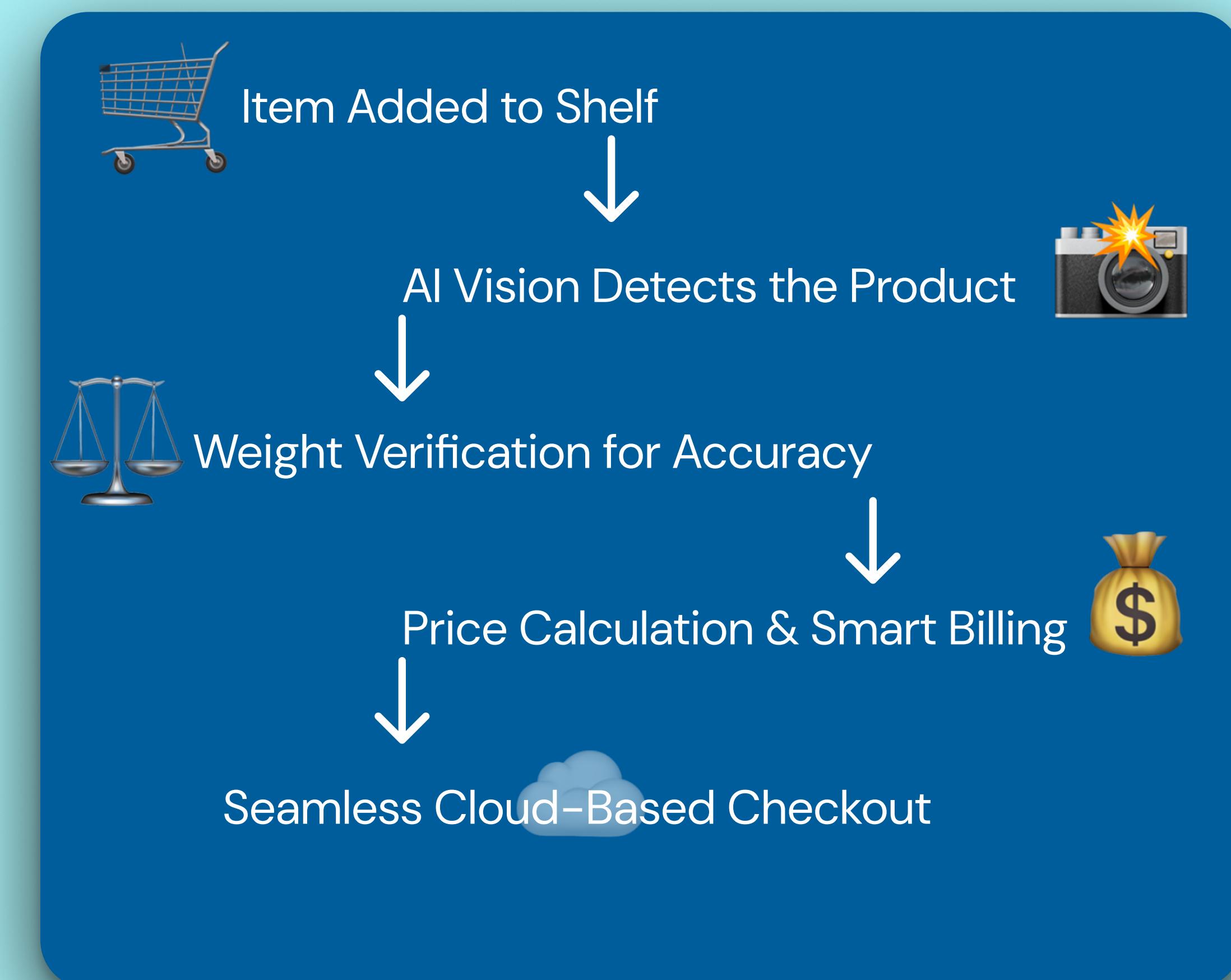
AI Vision

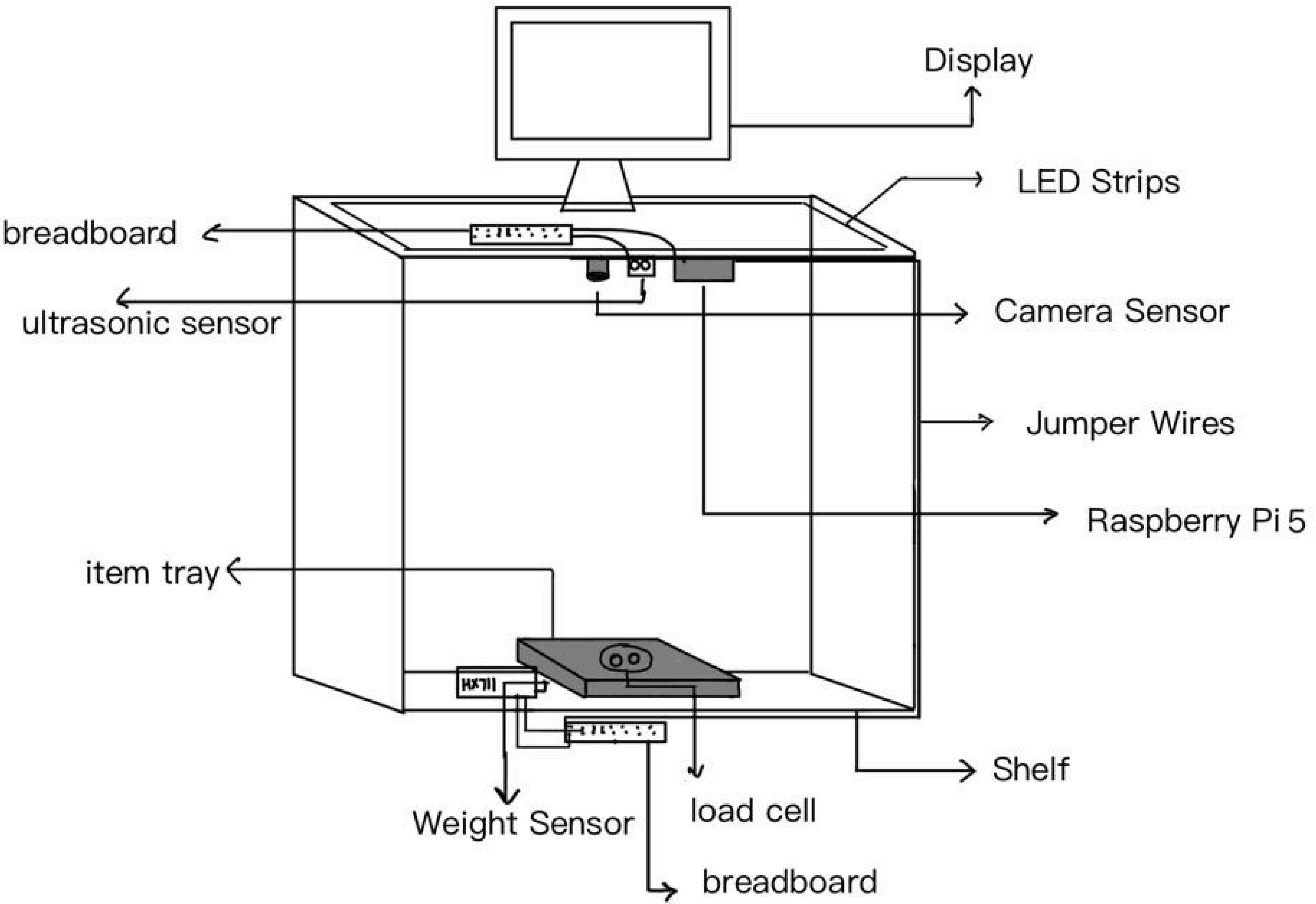


Smart Billing

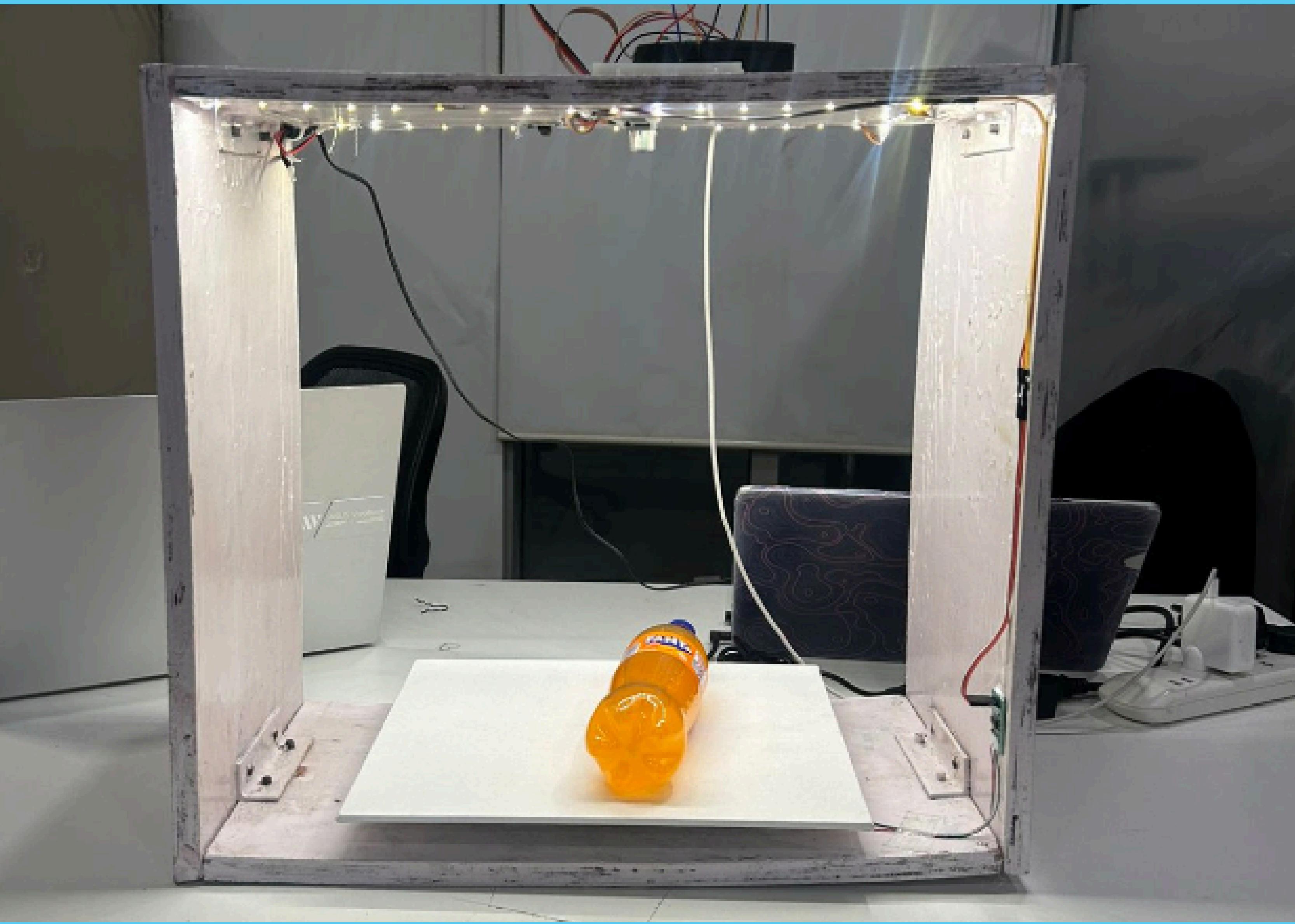


Weight Verification





# INITIAL PROTOTYPE



# FINAL PROTOTYPE

# **IEEE Standards to be used**

- IEEE 829-2008 – Software & System Test Documentation.
- IEEE 29148-2018 – API Documentation Standard.
- IEEE P7003 – Algorithmic Bias Considerations.
- PEP 8 – Python Code Style Guide.

# **UG Courses referred**

- Computer Vision & Image Processing.
- Embedded Systems.
- Machine Learning & AI.
- IoT & Sensor Technology.
- Database Management Systems.

# Ethical Considerations

- Secure Handling of customer purchase data.
- Environmental Concerns: Reducing Paper receipts.
- Responsible Ai to avoid biased or false product detection.

# Safety and Risk Mitigation

- Sensor Calibration to reduce mis-billing errors.
- Fail-safe backup in case of network outage.
- API Rate limiting.
- Hardware Protection.
- Error logs monitored at Backend.

# Impact Analysis

- **Technical Impact**
  - 70–80% faster checkout using automation
  - Real-time validation reduces billing discrepancies
- **Economic Impact**
  - Reduces cashier dependency → operational cost drop
  - Increased customer flow → higher revenue potential
- **Social Impact**
  - Queue-less shopping enhances accessibility & convenience
  - Improves shopping experience for elderly & differently-abled users
- **Environmental Impact**
  - Minimizes paper waste via digital invoicing
  - Efficient infrastructure reduces unnecessary energy usage
- **Organizational Impact**
  - Better data insights for inventory & theft analysis
  - Modernized branding aligned to smart retail transformation



**Thanks!**