

# **PROJECT PROPOSAL:**

## **SMART CHECKOUT SYSTEM (智能結帳系統)**

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# 1. Abstract

- **Problem:**

Customers always wait a long time for checkout. Even with self-checkout systems, the issue remains unsolved due to **the complexity of use and high implementation costs**.

- **Idea:**

Implement a **smart checkout system** using cameras for scanning, combined with image processing, object recognition and a conveyor system.

- **Objective:**

This system aims **to reduce checkout time**, enhance customer experience, and improve retail operational efficiency by using image detection in a embedded system.

## 2. Related Work in Taiwan

- Some company like Uniqlo may use **RFID** and put it in the tags, but the cost of the system may increase.
- Some company use barcode and customers need to find the **barcode** on the package, and scan the barcode to the system. But it is difficult to use due to the procedure.



[1]



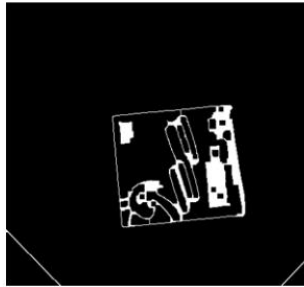
[2]

[1] Uniqlo 自助結帳機

[2] 家樂福自助結帳機

## 2. Related Work

- S. T. Bukhari, A. W. Amin, M. A. Naveed, and M. R. Abbas, “ARC: A Vision-based Automatic Retail Checkout System,” \*Dept. of Mechatronics and Control Engineering, University of Engineering and Technology, Lahore, Pakistan\*, 2021. [Online]. Available: <https://arxiv.org/abs/2104.02832>



(d) Morphological closing over 7c



(e) Bounding boxes from 7d

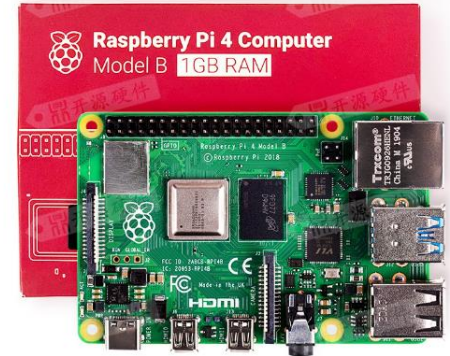
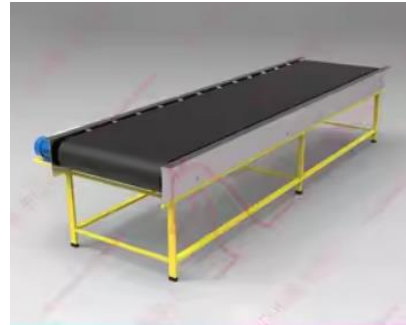


(f) Segmented and cropped



### 3. System Specifications

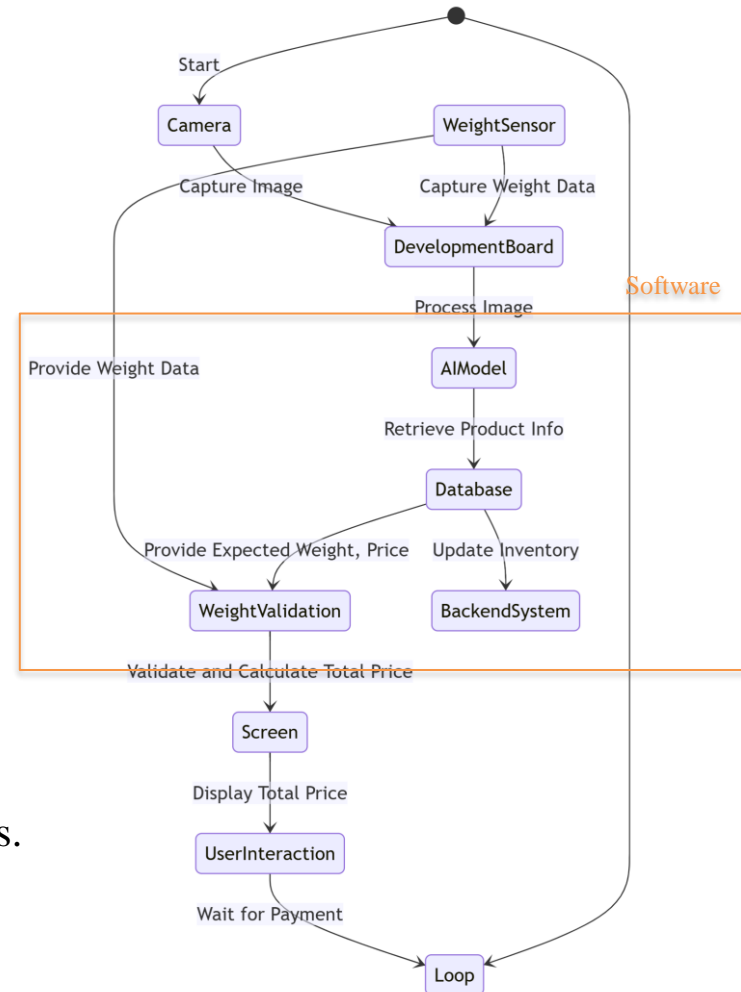
- **Camera:**  
Used to capture images of the products. It could be a camera module or simply using the camera on a smartphone and then connects to the system via communication protocols.
- **Weight Sensor:** To verify that the product matches the recognition result.
- **Development Board:** Raspberry Pi or Arduino
- **Buzzer or speaker** are also needed to warning system.
- **A Conveyor belt system.**



# 4. System architecture

- Using camera to capture the image, and weight sensor to get the weight.
- AI model detects the price and use weight to validate the correction.
- Change the inventory system. And show the total price to the screen.
- Using the Conveyor belt to output the items.
- If something warning or cheating, rings the buzzer.

Implement by myself: the SW. flow and AI model, using libraries.



# 5. Performance Evaluation and Functionality Validation Plan

- **Accuracy Test:**  
Test product recognition accuracy using multiple datasets under different lighting conditions and arrangements, aiming for over 90% accuracy.
- **Stress Test:** Place multiple products simultaneously to test the system's ability to accurately identify and process all items.
- **Response Time Test:** Measure the time taken from product placement to the display of the price, ensuring it is completed within 3 seconds.