



# Stock Count Automation

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Transforming manual stock counting into a smart, camera-powered solution.

Presented by

Waranthorn Chansawang

[link to slide](#)



## Problem



At F&N Thailand, manual stocktaking still presents several challenges, as shown below.

**Business**



**High risk of human error**



**Time-consuming and repetitive work**



**High cost of barcode scanning equipment**

**Operational**



**Low Image Quality & Lighting Variations**



**Partial Quantities Outside Standard Boxes**



**Missing Items in Database**

Introduction

Methodology

Results

Conclusions

testing in a real environment

## System Requirements



## BARCODE SCANNER



- 1 Mobile Barcode Scanning**  
Supports barcode scanning directly via mobile phone camera without extra hardware.
- 2 Quantity Input Interface**  
Allows users to enter product quantities manually via an intuitive interface, supporting EA, DSP, & CS units.
- 3 Export in Excel-Compatible Format**  
Allows exporting data in a format compatible with existing Excel stocktaking templates.
- 4 Support for Low-Quality Cameras**  
Ensures compatibility with mobile devices that have poor camera quality or lighting conditions.
- 5 Manual Item Entry**  
Must support adding new items when a scanned barcode is not found in the database.

# Timeline



	Week 1	Week 2	Week 3	Week 4	Week 5
R&D	PyZBar Deep Learning				
Develop ver 1		Get Req Develop ver 1			
Develop ver 2			Test Develop ver 2		
Develop ver 3				Changes Develop ver 3	
Documents		Slide ver 1	Slide ver 2		Slide ver 3 User Manual

# Barcode



**EAN-13** is a 13-digit barcode standard used worldwide to identify products. It appears on everyday items like milk cartons, water bottles, food, and appliances. This system is essential for streamlining retail sales, inventory control, and supply chain management globally.

Thailand Code  
885 is assigned by GS1 Thailand.

4 0 0 6 3 8 1 3 3 3 9 3 X

Position	Value	Multiply	Result
D1	4	×1	4
D2	0	×3	0
D3	0	×1	0
D4	6	×3	18
D5	3	×1	3
D6	8	×3	24
D7	1	×1	1
D8	3	×3	9
D9	3	×1	3
D10	3	×3	9
D11	9	×1	9
D12	3	×3	9
<b>Total = 89</b>			

$$\text{Checksum} = (10 - (89 \% 10)) \% 10 = (10 - 9) \% 10 = 1$$

Therefore, the 13th digit is 1 → 4 0 0 6 3 8 1 3 3 3 9 3 1

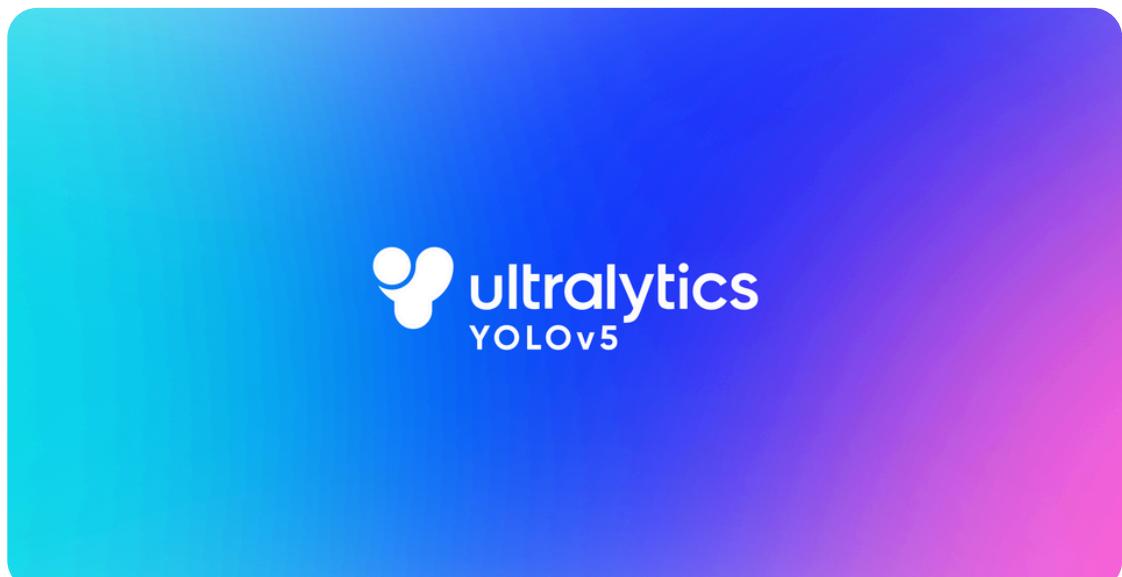
# Barcode Detection Techniques



1

## Deep Learning

YOLOv5 for detect barcode area



**mAP@0.5: 99.43%**

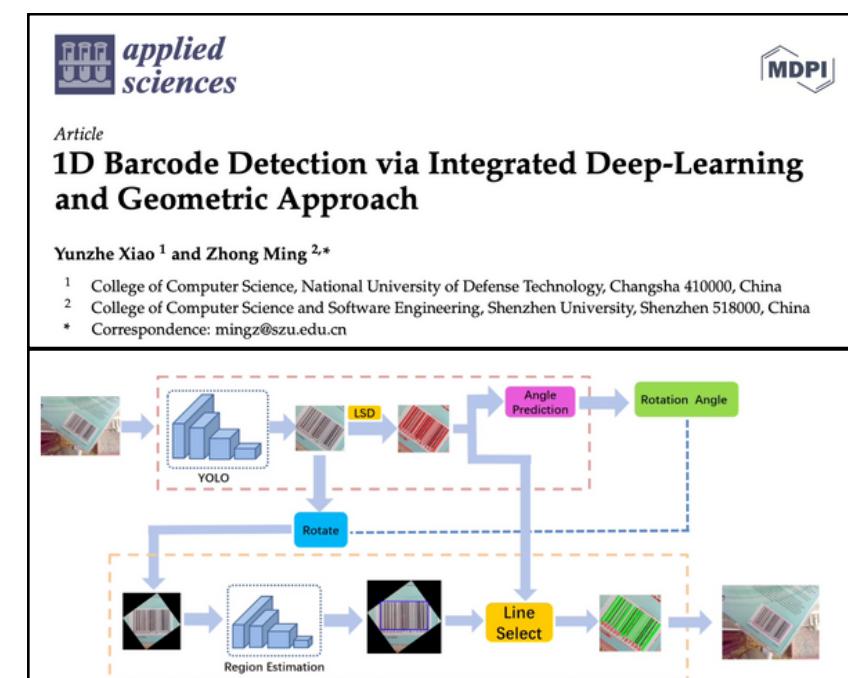
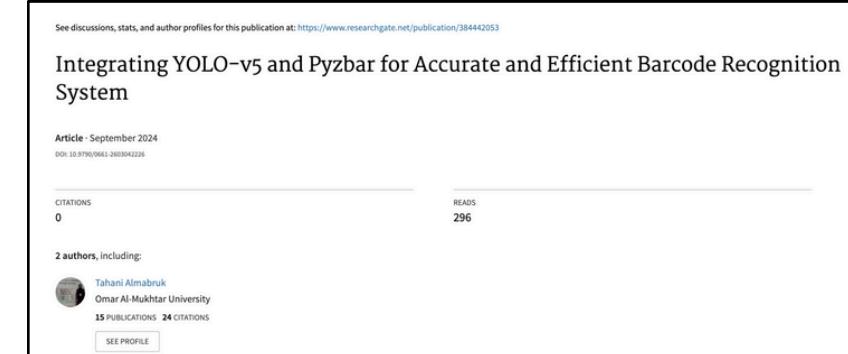
**mAP@0.5: 0.95: 73.06%**

Fast and accurate detection

Optimized for mobile deployment

Strong performance on  
small object detection

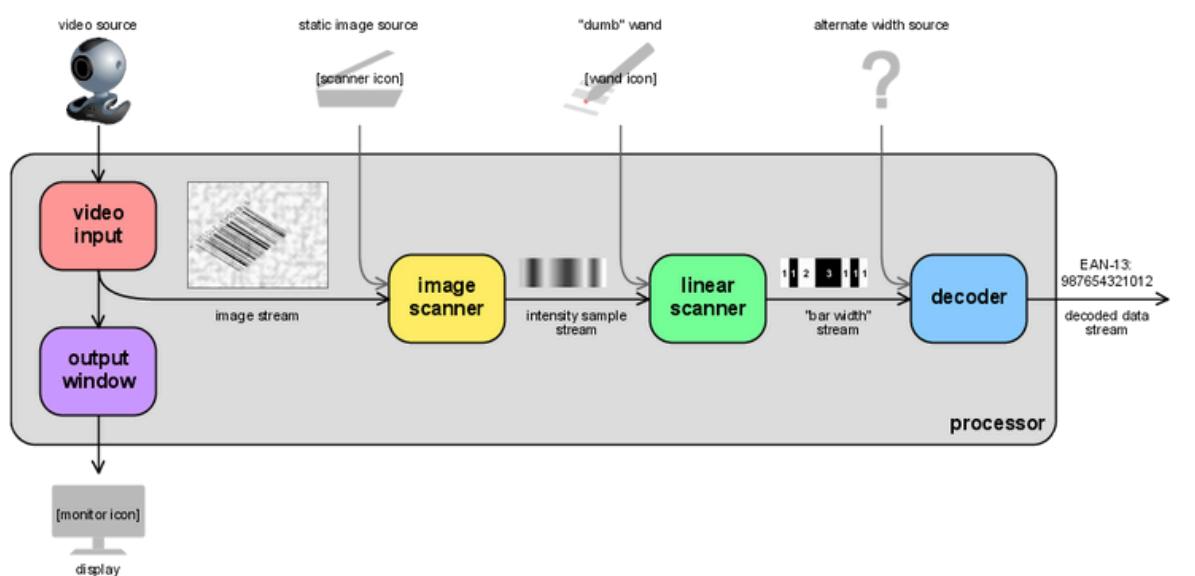
## Support Previous Researches



2

## PyZBar

for decode barcode value



Easy to use and implement.

Supports EAN-13, Code128, QR formats

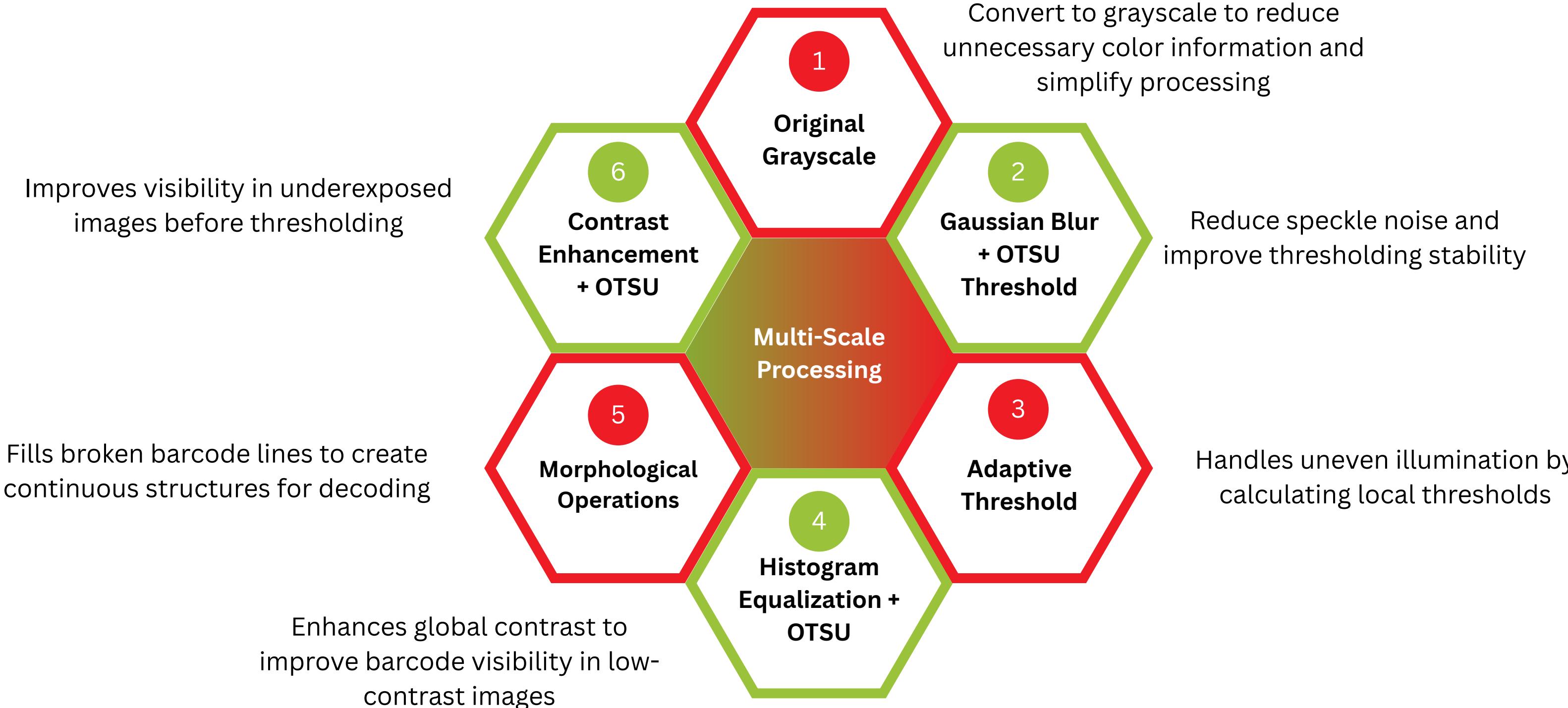
Lightweight and fast on clear images.

No support for  
distorted or rotated  
images.

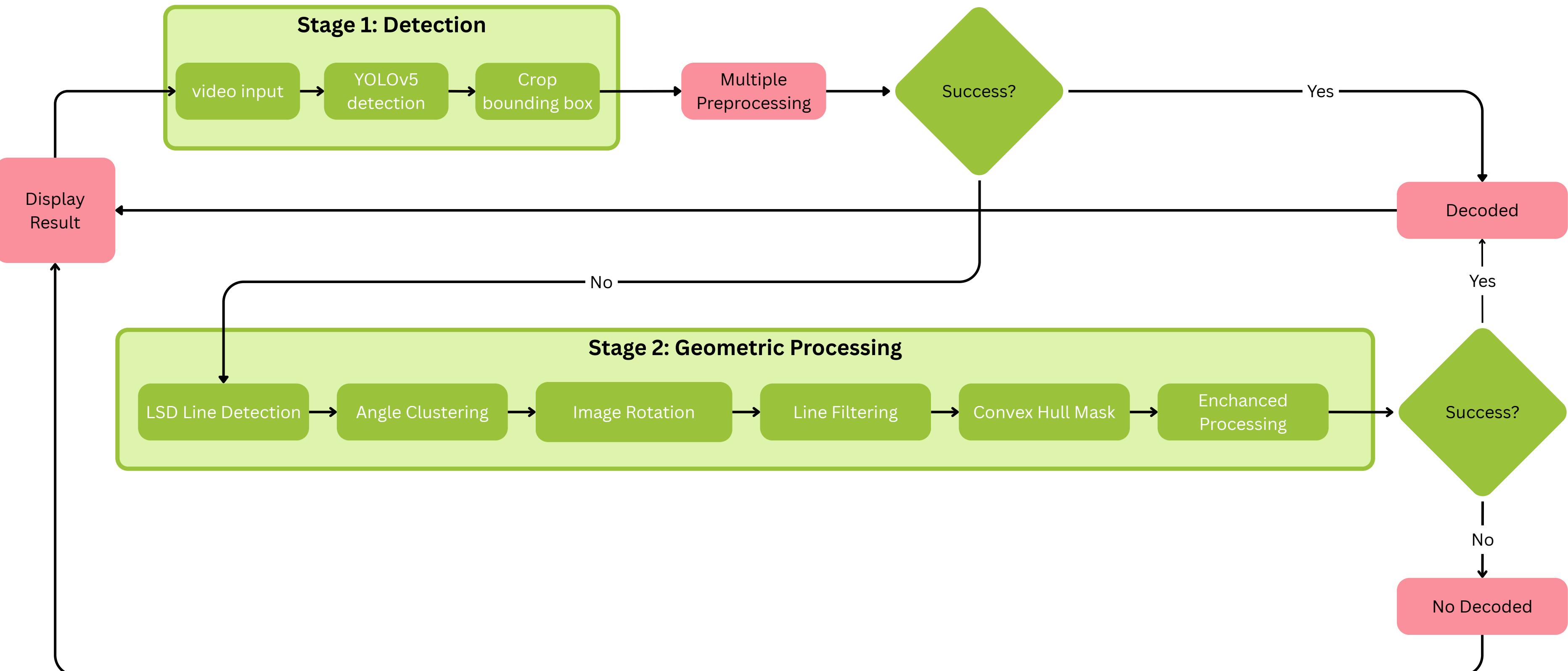
Poor performance  
with glare or low  
light.

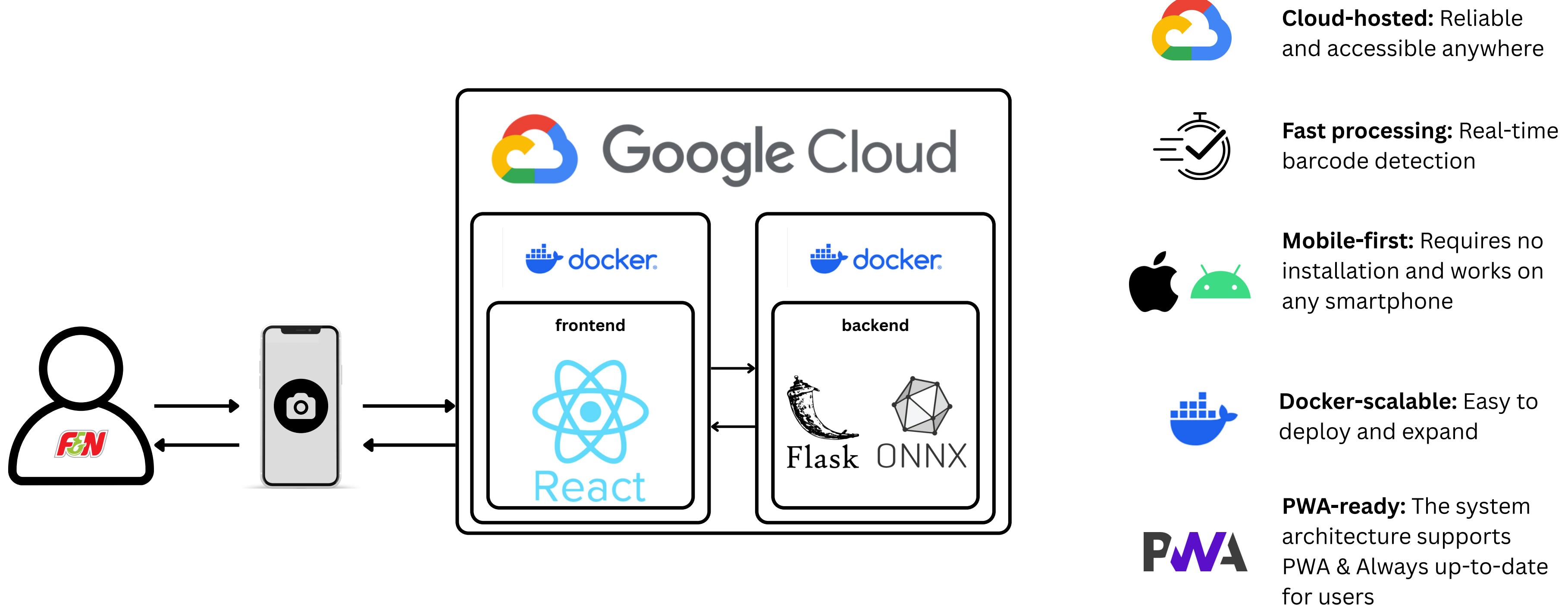
YOLOv5 + Pyzbar:  
97% detect, 91% decode  
Geom. Correction: +5% acc, 19ms

**PyZbar requires high-contrast images with sharp edges in order to decode barcodes accurately.**

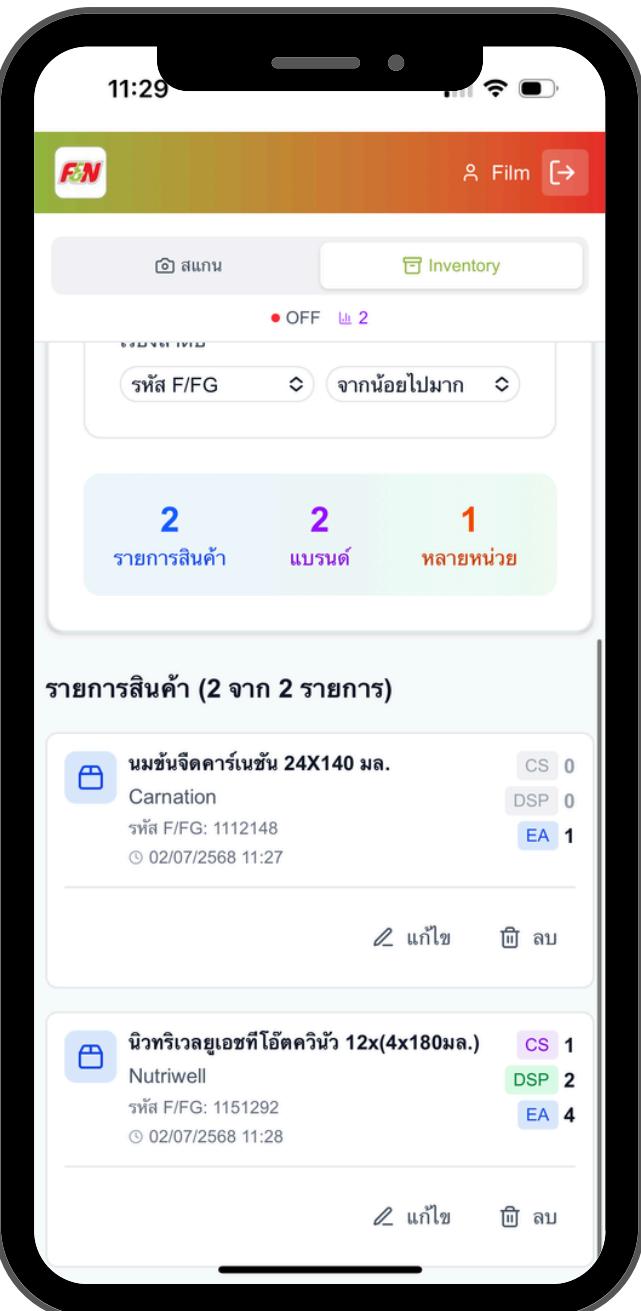
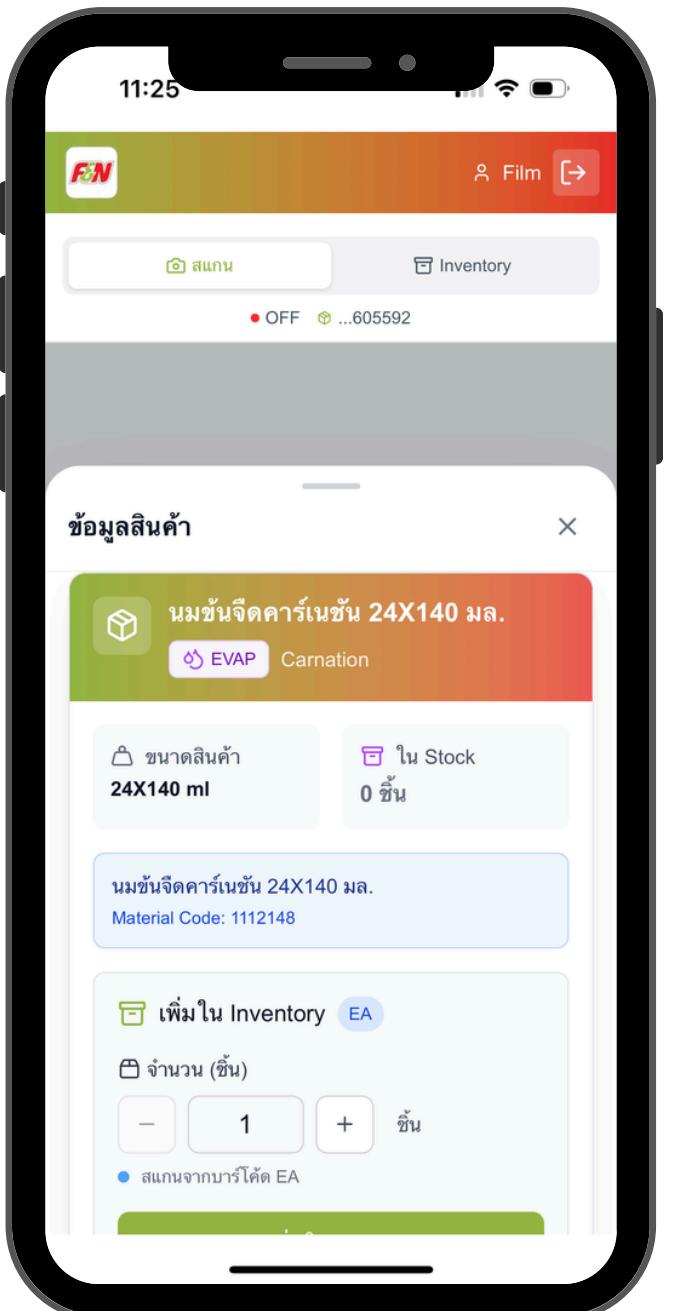
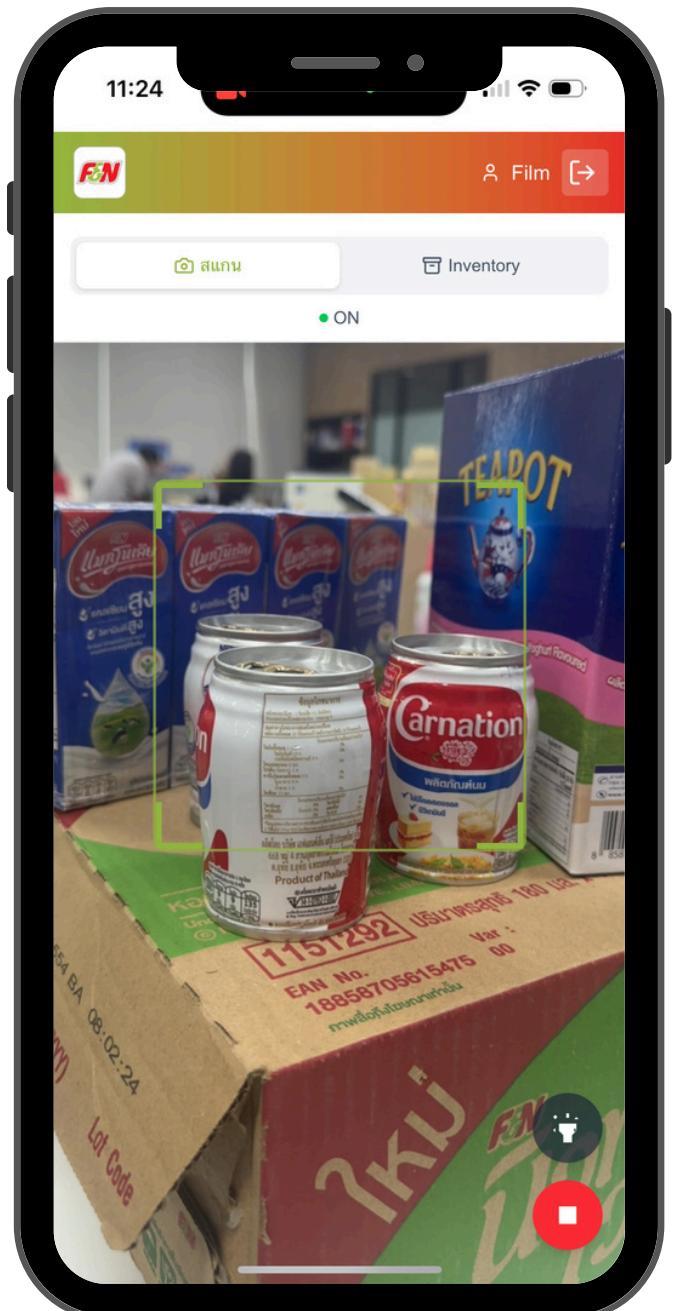
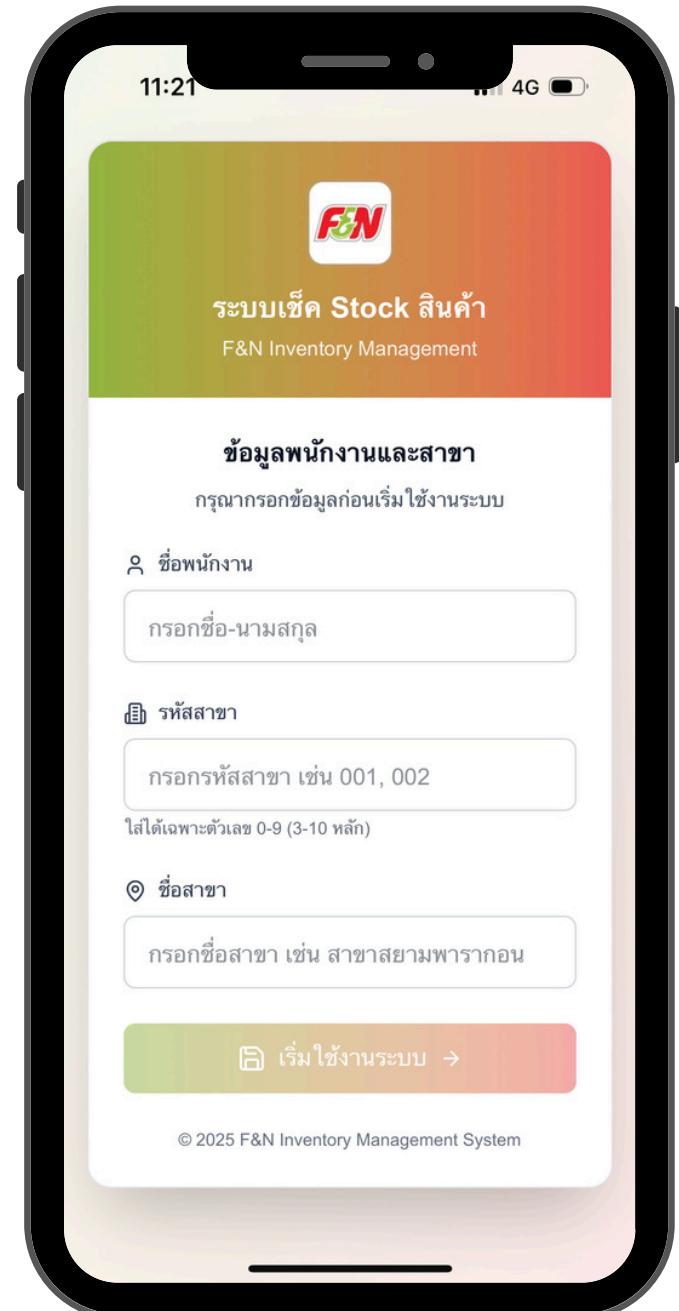


# Workflow





# Web Application



[link to demo](#)



[link to manual](#)

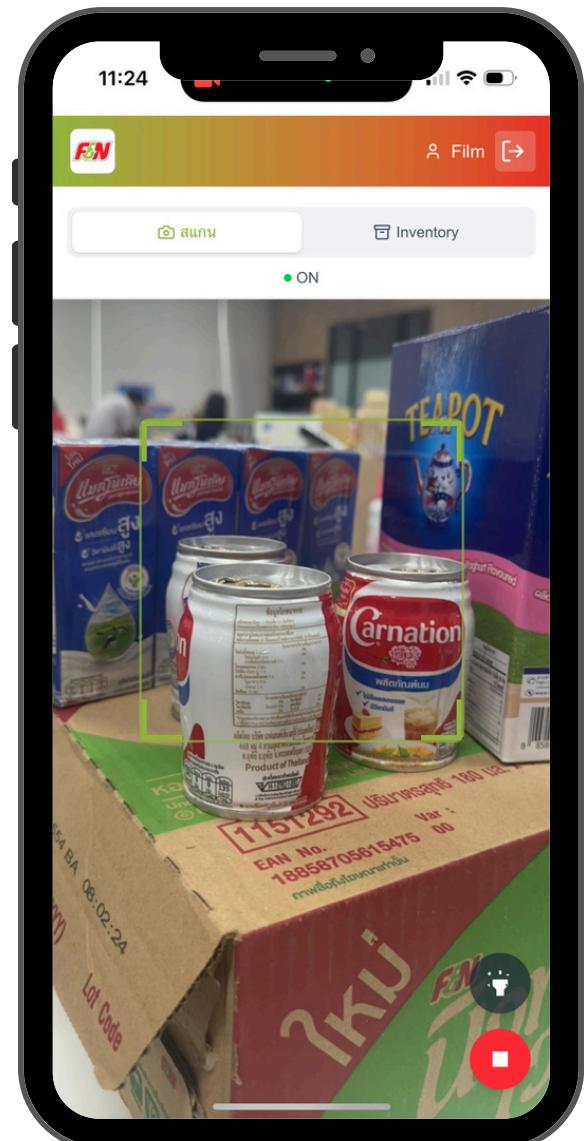


## New Features (Ver 3)



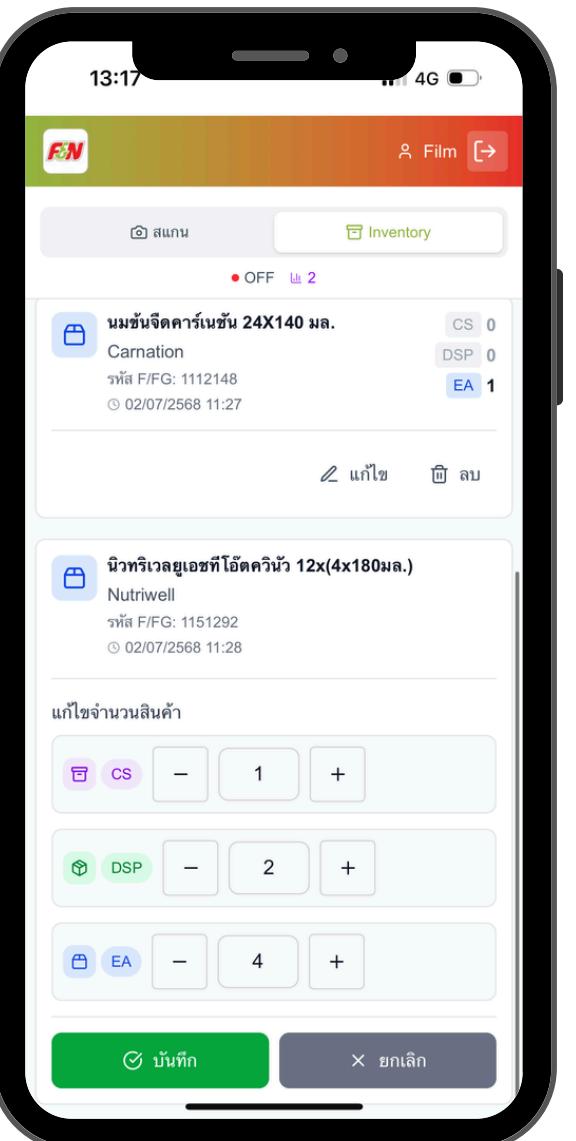
### Flashlight Support

Enable flashlight for better barcode scanning in low light.



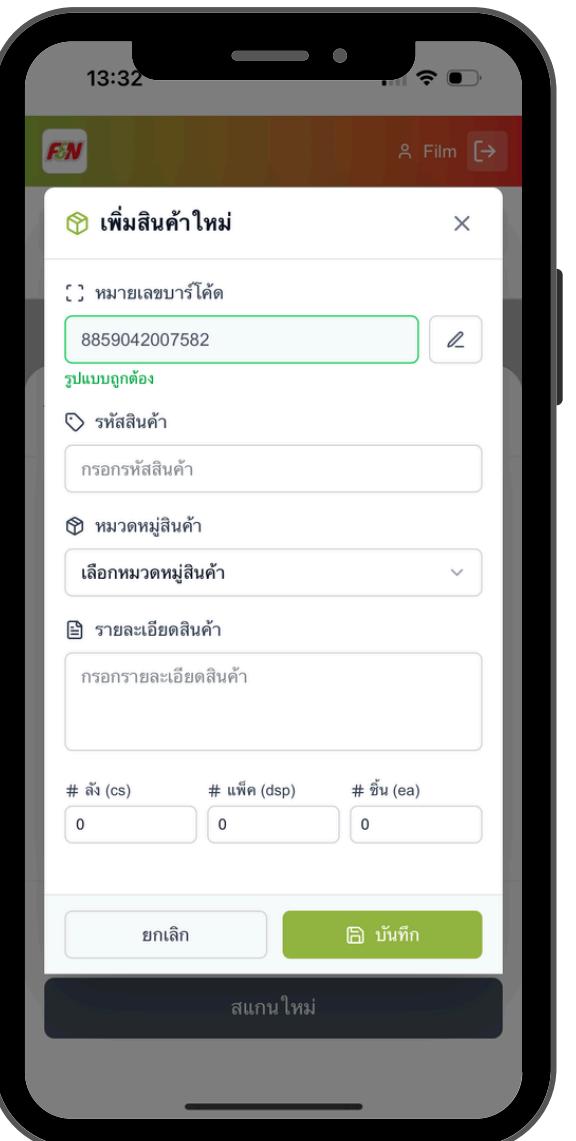
### Unit Flexibility

Support various units (pack, box, carton) for flexible counting.



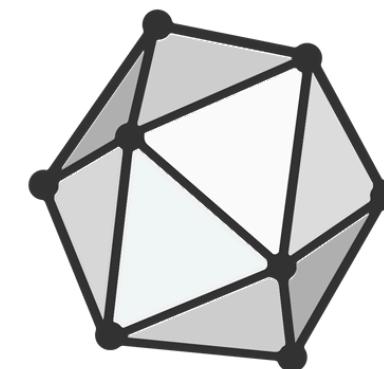
### Add new product

Manually add new products with custom details.



### Model Optimization

Convert and optimize the model to ONNX for faster mobile inference



# ONNX

- Faster build time
- Minimize memory usage



## Security Features Added (for Pentest)

**1**

### 1. Input Validation & Sanitization

- XSS Prevention & Script Injection Protection
- Pattern Detection for suspicious keywords
- Whitelist Filtering & Character length limits

**2**

### File Upload Security

- Extension Whitelist (.jpg, .png, .bmp only)
- Content validation with cv2.imdecode()
- Process and discard approach (no file storage)

**3**

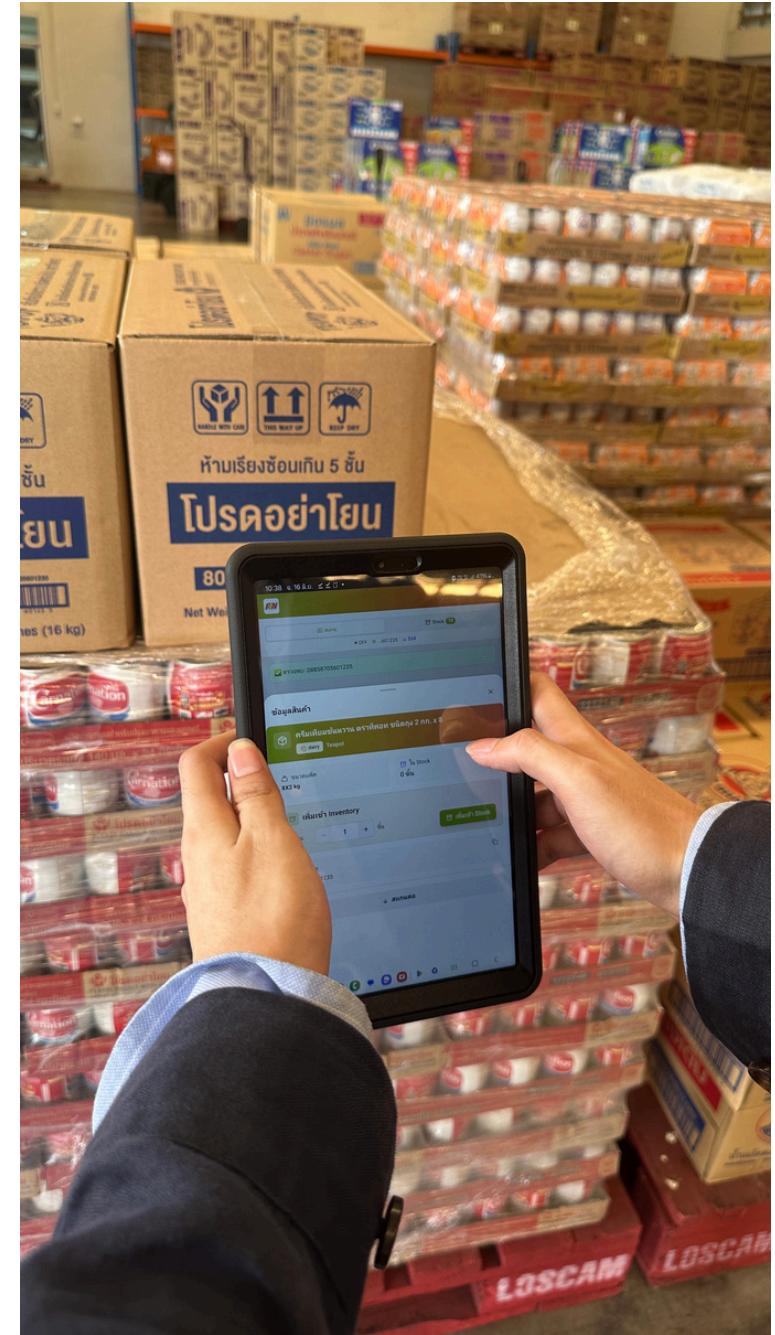
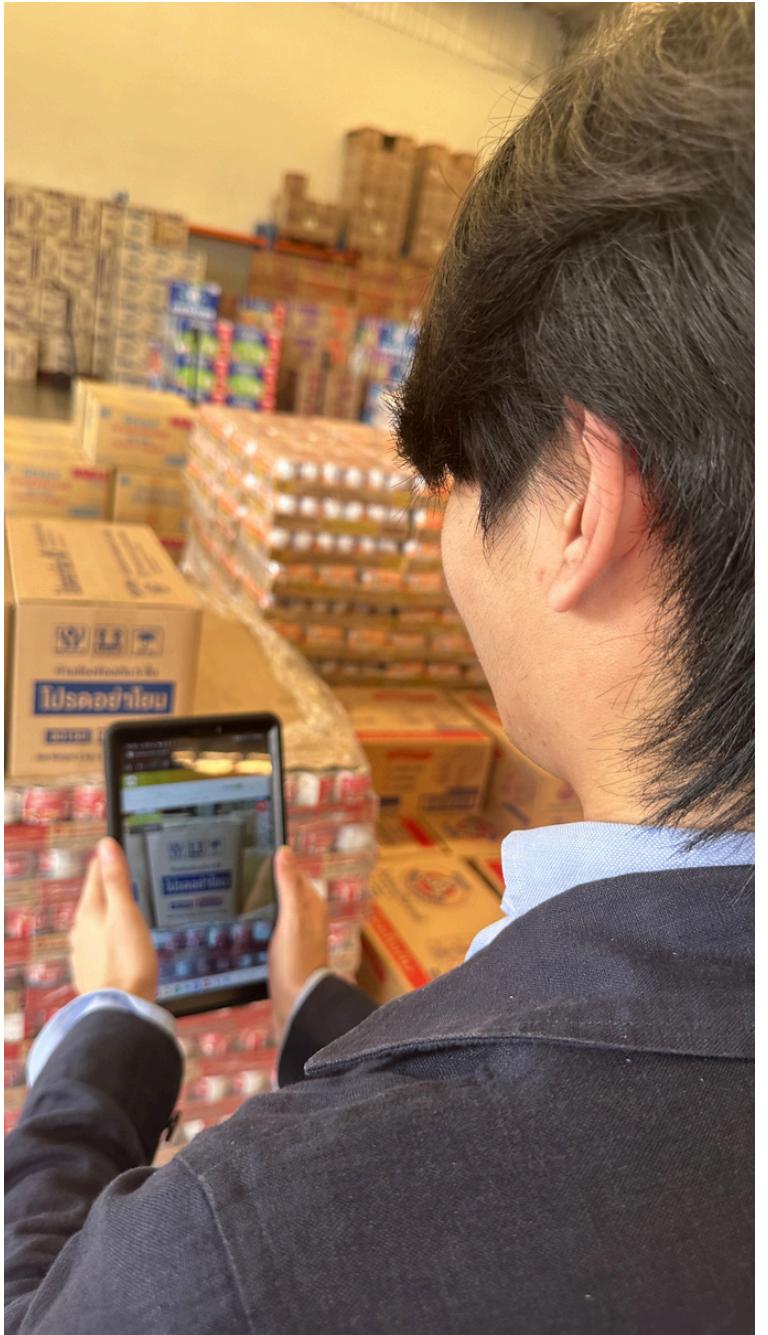
### Session Management

- 3-hour session timeout
- Automatic logout on expiration
- Secure session state management

## Supports raw material (kg)

Material	Material Description	
6000017	Whey Sweet Pwdr Heat Stable 25kg Hal	
6005365	Whey Sweet Pwd 25kg Hal Act29 (AEO)	
6000016	Milk Skimmed Pwd Regular 25kg	
6000136	Milk Skimmed Pwd UHT 25kg	
6000140	Milk Skimmed Pwd BOI 25kg	
6003580	Milk Skimmed Pwd 25kg Act 29 (AEO)	
6000156	Buttermilk Pwdr Sweet 5% Sterilized 25kg	
6000157	Buttermilk Pwdr Sweet 7% Ster 25kg Exp	
6003222	Partly Skimmed Milk Powder	
6004855	Anhydrous Milkfat SMF27	
6006167	Milk Permeate Powder	

# Field Testing at Thanasiri Distributor



System Overview

Data & Output

Technical Details



**Mobile Scanner**  
no extra hardware

YOLOv5  
**97%**  
detection

PyZBar  
**91%**  
decoding

Geometric Correction  
more accurate barcode decoding

**+5%**

**Unit Flexibility**  
EA / DSP/ CS



ONNX

faster inference and lower  
memory consumption



Excel Export  
Ready



Flashlight  
Support



Detect and decode barcodes in under  
**1 sec**



**Secure & Private**  
All data stays  
on-device

**Custom Item**  
Entry

Add new or  
missing  
products  
manually



Use via browser & No install needed

## System Overview

What is FNDT Stock Count Automation and what does it do?

Does the system require installation?

How is this system different from traditional barcode scanners?

Is there documentation or user manual available?

## Data & Output

Where is the data stored? Is it secure?

How do I manually update or add product information to the database?

Is it possible to edit existing product details (e.g., name, unit type)?

## Technical Details

What barcode formats are supported?

What is React and why is it used in this project?

What is ONNX and why is it used in this project?

What is Docker and why is it used in this project?

What is Flask and why is it used in this project?

What is PWA and why is it used in this project?

Can the system be updated or scaled easily?

Does the system support rotated or distorted barcodes?

## What is FNDT Stock Count Automation and what does it do?



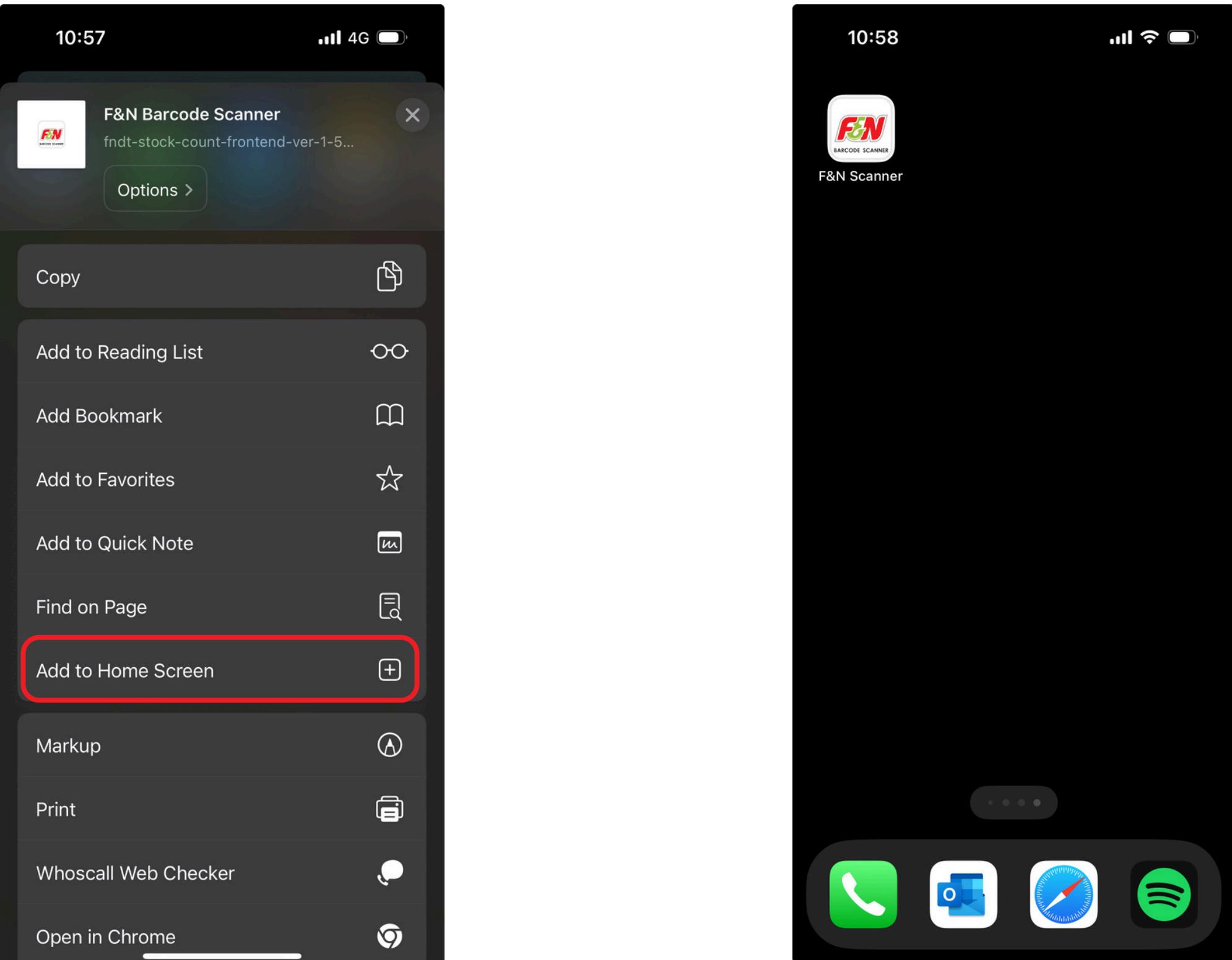
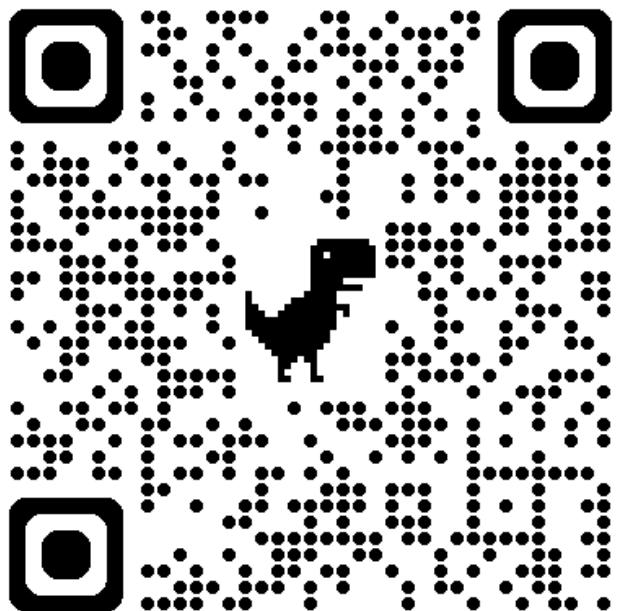
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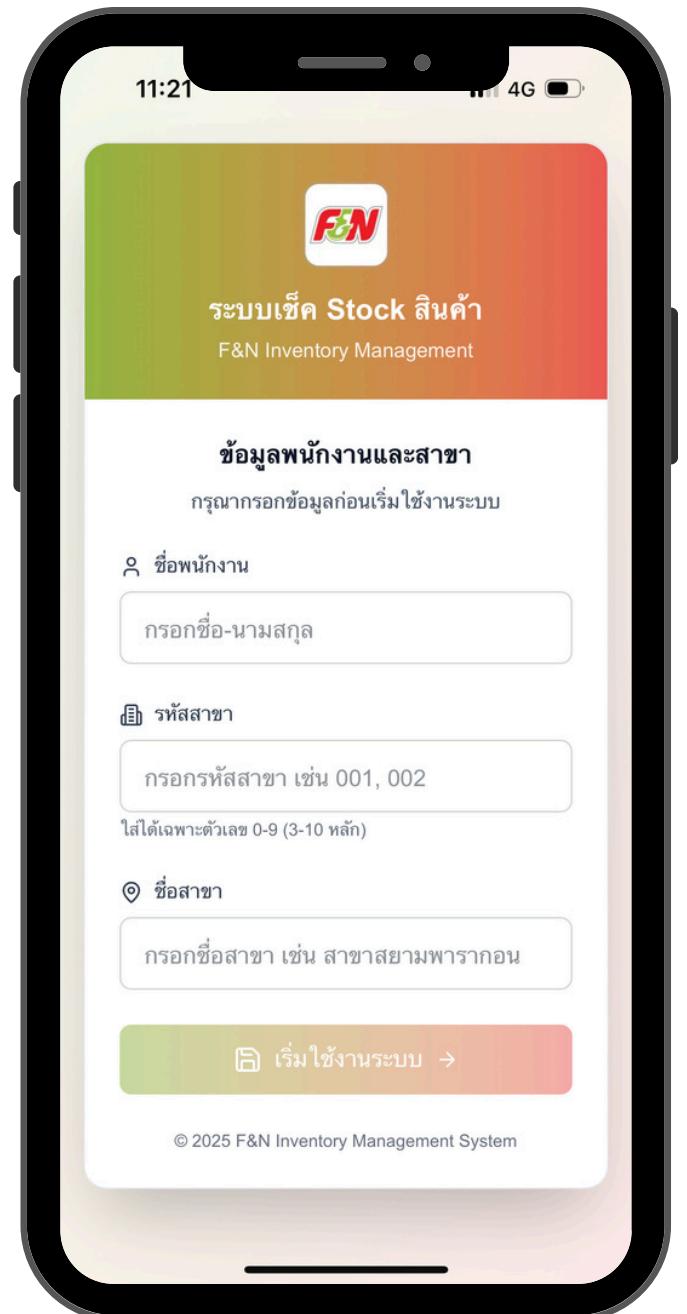
# Does the system require installation?



**link to demo**



## How is this system different from traditional barcode scanners?



No need for extra hardware

Works on any smartphone

Handles rotated/distorted barcodes

Supports quantity input & Excel export

Much cheaper than traditional scanners

Is there documentation or user manual available?



# User Manual

for Stock Count Automation



## Where is the data stored? Is it secure?



### Data Stored Locally (on Device / Browser)

#### 1. Scanned Inventory Data

Key: "fn\_inventory\_data"

Value: All scanned product entries along with quantity

This data contains a list of all products that have been scanned by the user, including their respective quantities.

#### 2. Logged-in Employee Information

Key: "fn\_employee\_session"

Value: Employee name, branch ID, login timestamp

This keeps track of the currently logged-in staff member for session consistency and audit purposes.

#### 3. Product List CSV File

Location: /public/product\_list\_csv.csv

Storage: Server-side (publicly accessible)

This CSV file contains the official product database and is hosted on the server, accessible by the frontend for barcode matching and product detail lookup.

# How do I manually update or add product information to the database?



Code File Edit Selection View Go Run Terminal Window Help

product\_list.xlsx product\_list\_csv.csv

public > product\_list\_csv.csv > data

```

1 Material,Description,Thai Desc.,Pack Size,Product Group,Shelflife (Months),Bar Code EA,Bar Code DSP,Bar Code CS
58 1151238,MAGNOLIA UHT CHOCOLATE,นมแมกโนเลีย ชoco้ช์ที่ รสช็อกโกแลต 12x(4x18),12x(4X180 ml),Magnolia UHT,9,8858705612224,8858705612231,188587
59 1151286,Magnolia UHT Plain 12x(4x180ml)10B.,นมแมกโนเลียชูอช์ที่จีด 12x(4x180ml)10B.,12(4x180 Ml.),Magnolia UHT,9,8858705615089,8858705615
60 1151287,Magnolia UHT Choc 12x(4x180ml) 10B.,นมแมกโนเลีย ชูอช์ที่ รสช็อก 12x(4x180ml)10B.,12(4x180 Ml.),Magnolia UHT,9,8858705615119,88587
61 1151292,Nutriwell UHT Oat and Quinoa 12x(4x180ml),น้ำทริเวลชูอช์ที่โอ๊ตควิน้า 12x(4x180ml),12x(4x180ml),NUTRISOY,9,8858705615454,8858705615
62 1151293,Nutriwell UHT Omega Flax 12x(4x180ml),น้ำทริเวลชูอช์ที่โอเมกแฟล็กซ์ 180ml(4x12),12x(4x180ml),NUTRISOY,9,8858705615485,8858705615492
63 1201514,HAYOCO COOL COLA 70GX12X4 TH,ชาโยโก้ กัมฟี่ คูลโคล่า 70g x 12 x 4,70GX12X4,Gummy,18,9556296 331270,9556296 331317,09556296 331607
64 1201578,HAYOCO BERRY BEAR 70G X 12 X 4 TH,ชาโยโก้ กัมฟี่ เบอร์รี่ แบร์ 70g x 12 x 4,70GX12X4,Gummy,18,9556296 331263,9556296 331553,0955629
65 1201617,HAYOCO BERRY BEAR 15G X 12 X 12 TH,ชาโยโก้ กัมฟี่ เบอร์รี่ แบร์ 15g x 12 x 12,15G X 12 X 12,Gummy,18,9556296 331256,9556296 331294,0
66 1201618,HAYOCO COOL COLA 15G X 12 X 12 TH,ชาโยโก้ กัมฟี่ คูลโคล่า 15g x 12 x 12,15G X 12 X 12,Gummy,18,9556296 331249,9556296 331560,0955
67 2000085, Magnolia Past FullCreamMilkPlain 1x800ml TH, Magnolia Past FullCreamMilkPlain 1x800ml TH, 1x800ml, Milk, -, 8858705600900,
68 2000086, Magnolia Past Low Fat Milk Plain 1x 800ml TH, Magnolia Past Low Fat Milk Plain 1x 800ml TH, 1x 800ml , Milk, -, 88587056009
69 2000120, Magnolia Past FullCreamMilk Plain 5000ml TH, Magnolia Past FullCreamMilk Plain 5000ml TH, 5000ml, Milk, -, 8858705600924 ,
70 1130111, Magnolia Past Low Fat Milk Plain 2000ml TH, Magnolia Past Low Fat Milk Plain 2000ml TH, 2000ml, Milk, -, 8858705602966, -
71 1130112, Magnolia Past FullCreamMilkPlain 2000ml TH, Magnolia Past FullCreamMilkPlain 2000ml TH, 2000ml, Milk, -, 8858705602959, -
72 2000134, Magnolia Choc Malt Pasteurized Bottle 1x450ml, Magnolia Choc Malt Pasteurized Bottle 1x450ml, 1x450ml, Choc Malt, -, 885870
73 2000137, Magnolia Choc Malt Pasteurized Bottle 1x800ml, Magnolia Choc Malt Pasteurized Bottle 1x800ml, 1x800ml, Choc Malt, -, 885870
74 2000141, Magnolia Past Whipping Cream Gallon 5000ml TH, Magnolia Past Whipping Cream Gallon 5000ml TH, 5000ml, Foodservice, -, 885870
75 2000057, Magnolia Past Whipping Cream Box 1x946ml TH, Magnolia Past Whipping Cream Box 1x946ml TH, 1x946ml, Foodservice, -, 88587056
76 2000054, Magnolia Past Half Cream Box 1x946ml TH, Magnolia Past Half Cream Box 1x946ml TH, 1x946ml, Foodservice, -, 8858705600108, -
77 1130185, Magnolia Lactose Free Plain 400 ml, Magnolia Lactose Free Plain 400 ml, MAGNOLIA LACTOSE FREE, -, 8858705608715, -
78 1130186, Magnolia Lactose Free Plain 946 ml, Magnolia Lactose Free Plain 946 ml, MAGNOLIA LACTOSE FREE, -, 8858705608708, -
79 80108, Aro Whipping Cream 1900 ml. (Makro), Aro Whipping Cream 1900 ml. (Makro), 1900ml, SKU FOR MAKRO, -, 8858705601693, -, -

```

# Is it possible to edit existing product details (e.g., name, unit type)?



Code File Edit Selection View Go Run Terminal Window Help

product\_list.xlsx product\_list\_csv.csv

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```

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59 1151286,Magnolia UHT Plain 12x(4x180ml)10B.,นมแมกโนเลียชูอชที่จีด 12x(4x180ml)10B.,12(4x180 Ml.),Magnolia UHT,9,8858705615089,8858705615
60 1151287,Magnolia UHT Choc 12x(4x180ml) 10B.,นมแมกโนเลีย ชูอชที่ รสช็อก 12x(4x180ml)10B.,12(4x180 Ml.),Magnolia UHT,9,8858705615119,88587
61 1151292,Nutriwell UHT Oat and Quinoa 12x(4x180ml),น้ำทริเวลชูอชทีโอตัดวิน้า 12x(4x180ml),12x(4x180ml),NUTRISOY,9,8858705615454,8858705615
62 1151293,Nutriwell UHT Omega Flax 12x(4x180ml),น้ำทริเวลชูอชทีโอเมกแฟล็กซ์ 180ml(4x12),12x(4x180ml),NUTRISOY,9,8858705615485,8858705615492
63 1201514,HAYOCO COOL COLA 70GX12X4 TH,ชาโยโก้ กัมฟ์ คูลโคล่า 70g x 12 x 4,70GX12X4,Gummy,18,9556296 331270,9556296 331317,09556296 331607
64 1201578,HAYOCO BERRY BEAR 70G X 12 X 4 TH,ชาโยโก้ กัมฟ์ เบอร์รี่ แบร์ 70g x 12 x 4,70GX12X4,Gummy,18,9556296 331263,9556296 331553,0955629
65 1201617,HAYOCO BERRY BEAR 15G X 12 X 12 TH,ชาโยโก้ กัมฟ์ เบอร์รี่ แบร์ 15g x 12 x 12,15G X 12 X 12,Gummy,18,9556296 331256,9556296 331294,0
66 1201618,HAYOCO COOL COLA 15G X 12 X 12 TH,ชาโยโก้ กัมฟ์ คูลโคล่า 15g x 12 x 12,15G X 12 X 12,Gummy,18,9556296 331249,9556296 331560,0955
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70 1130111, Magnolia Past Low Fat Milk Plain 2000ml TH, Magnolia Past Low Fat Milk Plain 2000ml TH, 2000ml, Milk, -, 8858705602966, -
71 1130112, Magnolia Past FullCreamMilkPlain 2000ml TH, Magnolia Past FullCreamMilkPlain 2000ml TH, 2000ml, Milk, -, 8858705602959, -
72 2000134, Magnolia Choc Malt Pasteurized Bottle 1x450ml, Magnolia Choc Malt Pasteurized Bottle 1x450ml, 1x450ml, Choc Malt, -, 885870
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74 2000141, Magnolia Past Whipping Cream Gallon 5000ml TH, Magnolia Past Whipping Cream Gallon 5000ml TH, 5000ml, Foodservice, -, 885870
75 2000057, Magnolia Past Whipping Cream Box 1x946ml TH, Magnolia Past Whipping Cream Box 1x946ml TH, 1x946ml, Foodservice, -, 88587056
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77 1130185, Magnolia Lactose Free Plain 400 ml, Magnolia Lactose Free Plain 400 ml, MAGNOLIA LACTOSE FREE, -, 8858705608715, -
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```

## What barcode formats are supported?



**EAN-13** is a 13-digit barcode standard used worldwide to identify products. It appears on everyday items like milk cartons, water bottles, food, and appliances. This system is essential for streamlining retail sales, inventory control, and supply chain management globally.

Thailand Code  
885 is assigned by GS1 Thailand.

4 0 0 6 3 8 1 3 3 3 9 3 X

Position	Value	Multiply	Result
D1	4	×1	4
D2	0	×3	0
D3	0	×1	0
D4	6	×3	18
D5	3	×1	3
D6	8	×3	24
D7	1	×1	1
D8	3	×3	9
D9	3	×1	3
D10	3	×3	9
D11	9	×1	9
D12	3	×3	9
<b>Total = 89</b>			

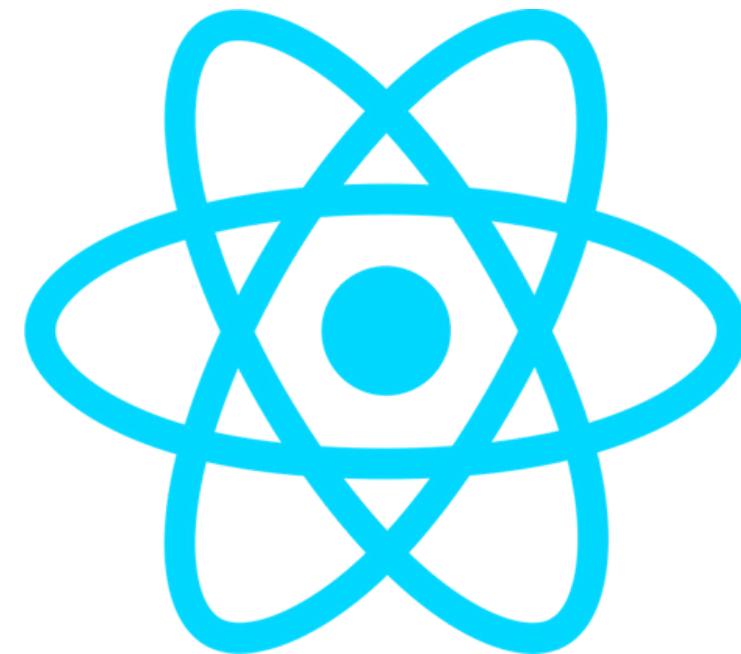
$$\text{Checksum} = (10 - (89 \% 10)) \% 10 = (10 - 9) \% 10 = 1$$

Therefore, the 13th digit is 1 → 4 0 0 6 3 8 1 3 3 3 9 3 1

## What is React and why is it used in this project?



React is a JavaScript library for building fast, responsive UIs.



# React



PWA

**Mobile-first:** Requires no installation and works on any smartphone

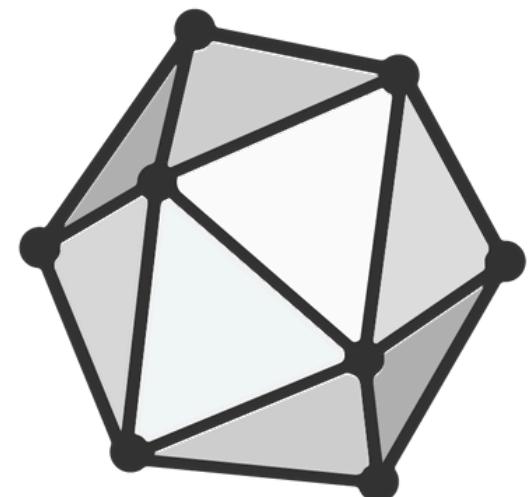
**Component-based:** Makes the app modular, maintainable, and easy to scale.

**PWA-ready:** The system architecture supports PWA & Always up-to-date for users

## What is ONNX and why is it used in this project?



ONNX is an open format for AI models that enables fast, cross-platform inference.



# ONNX



**Fast inference:** Runs models faster on mobile devices for real-time barcode decoding



**Lightweight:** Makes the app modular, maintainable, and easy to scale.

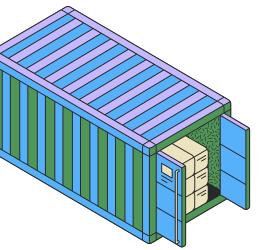


**Cross-platform:** Allows deployment on various environments (browser, mobile, server)

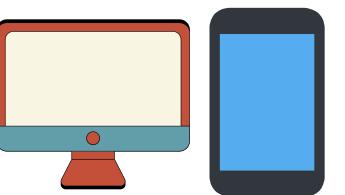
## What is Docker and why is it used in this project?



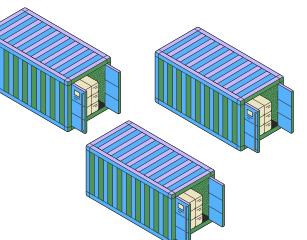
Docker is a platform that enables fast, portable, and consistent deployment across environments.



**Portable:** Package the app with all dependencies to run anywhere



**Consistent:** Avoids “it works on my machine” issues during deployment



**Scalable:** Easily spin up multiple containers to handle more users or load

## What is Flask and why is it used in this project?



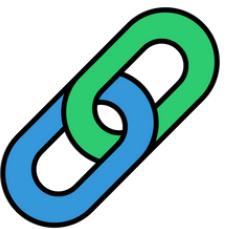
Flask is a lightweight web framework used to build the backend API for barcode processing and data handling.



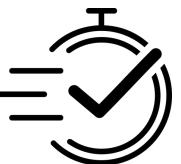
web development,  
one drop at a time



**Simple & Lightweight:** Easy to set up and fast for small-to-medium backend services



**API-friendly:** Great for building RESTful APIs to connect frontend (React) with backend logic



**Fast Prototyping:** Ideal for rapid development, testing, and deployment in research-based projects

## What is PWA and why is it used in this project?



# PWA

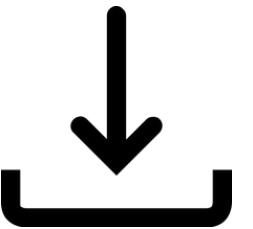
PWA is a modern web app approach that offers fast loading, app-like experience, and can be used directly from any browser.



with PWA



without PWA



**Installable:** Can be added to the home screen and launched like a native app



**Always accessible:** Runs on any device with a browser – no installation required

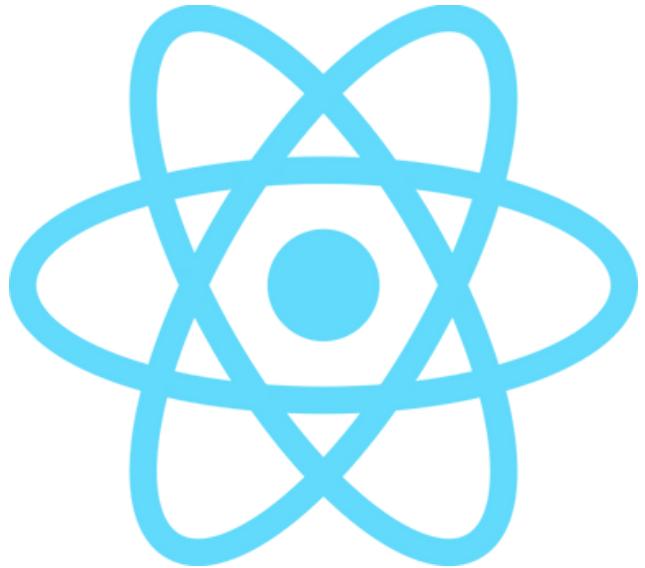


**Auto-updating:** Automatically loads the latest version when connected to the internet

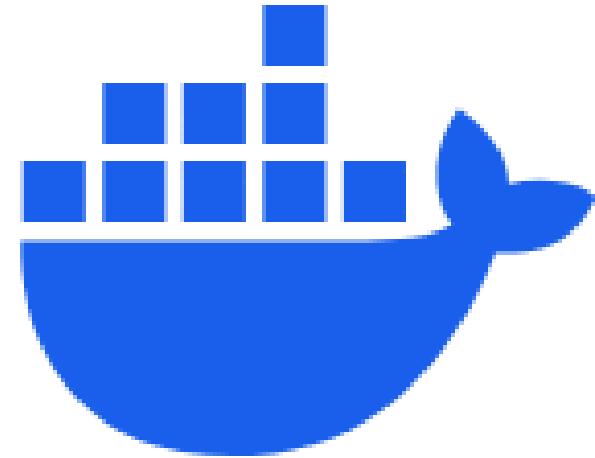
Can the system be updated or scaled easily?



# Yes, it can



Modular design simplifies feature expansion



enables fast, consistent updates

# Does the system support rotated or distorted barcodes?



# Yes!

## LSD

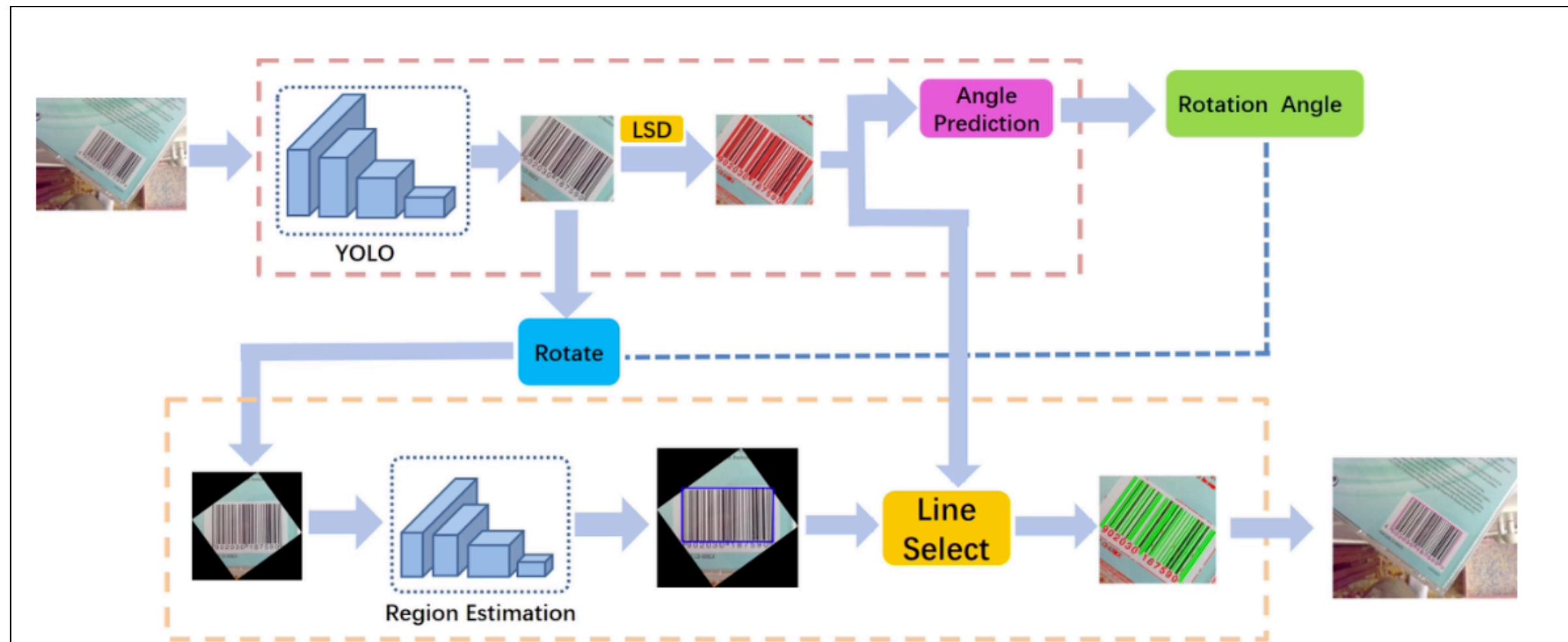
Applies Line Segment Detection (LSD) to extract all line segments within the bounding box

## Angle Prediction

Predicts the rotation angle of the barcode by clustering the angles of the detected line segments

## Rotation Angle

Outputs the estimated angle, which will be used to rotate and align the barcode image



## Rotate

Rotates the barcode region to correct orientation based on the predicted angle

## Region Estimation

A neural network estimates the rectangular region where the barcode is most likely located

## Line Select

Selects line segments whose midpoints fall within the estimated region (filters out noise)

# System architecture

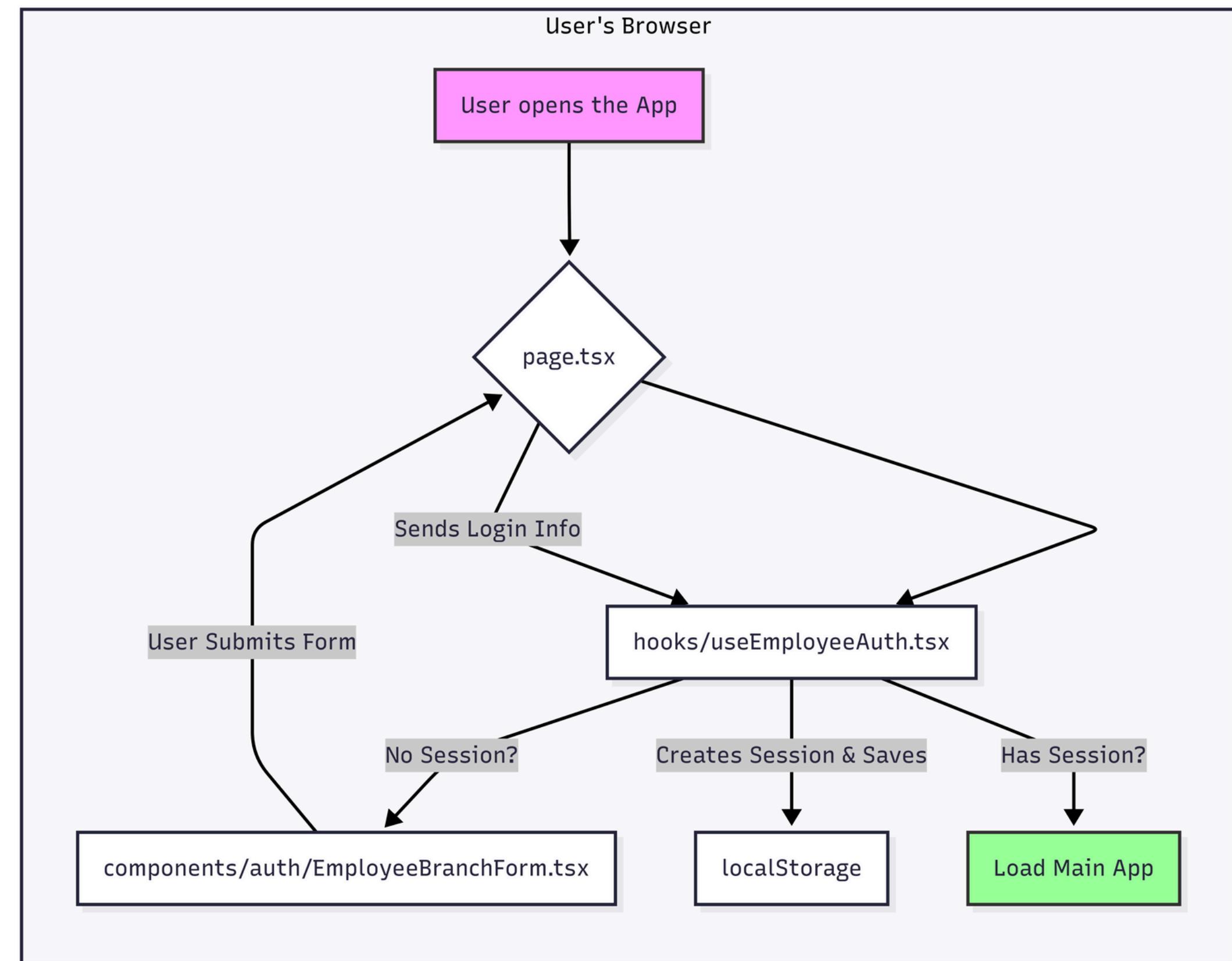


```

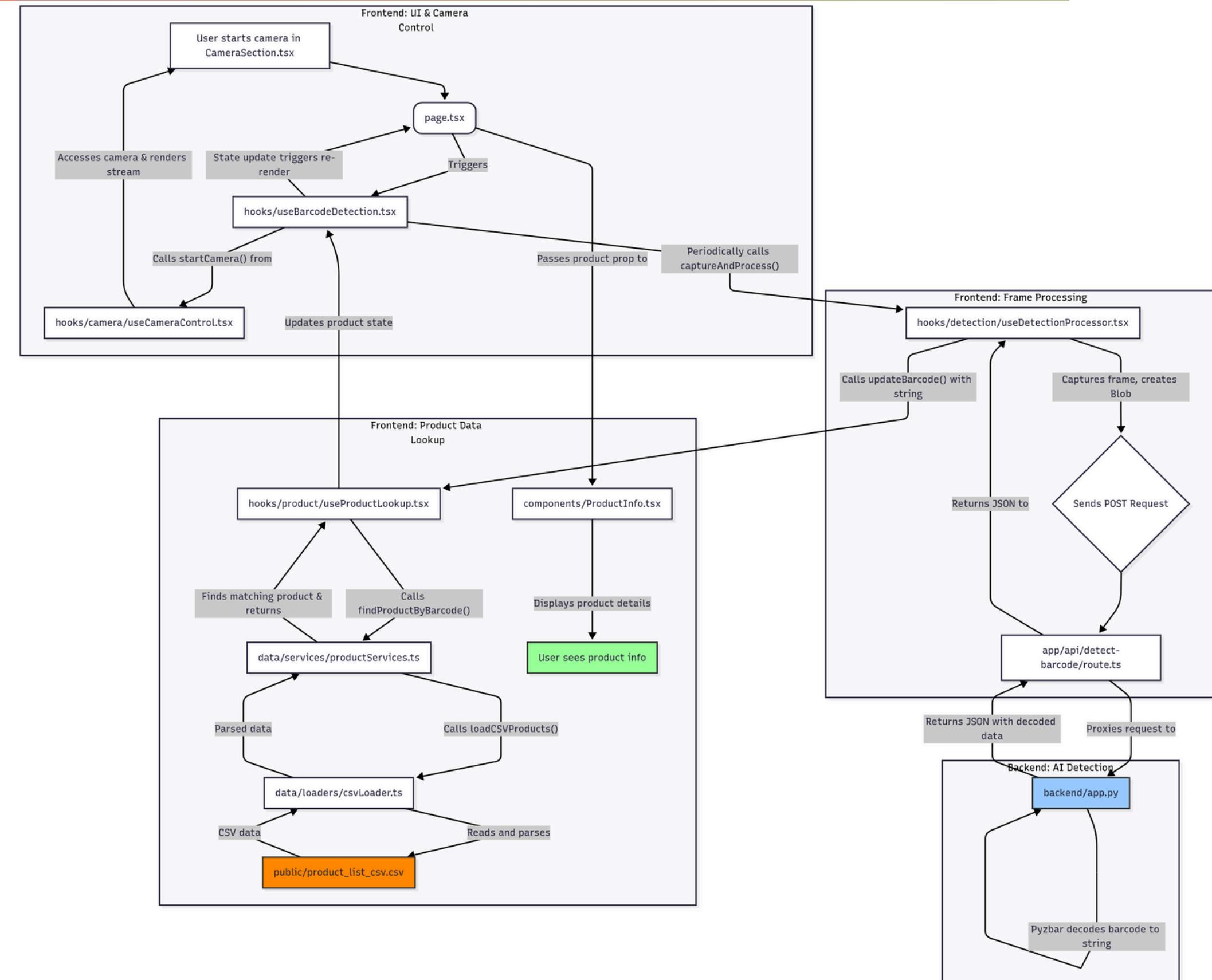
fnndt-stockcountautomation/
├── backend/
│   ├── app.py          # [Backend] Main Flask API file for barcode detection
│   ├── convert_to_onnx.py # [Backend] Script to convert the PyTorch model to ONNX format
│   └── requirements.txt  # [Backend] List of required Python libraries
|
├── public/
│   ├── product_list_csv.csv # [Data] The entire product database in CSV format
│   └── ... (Other public files like images, manifest.json)
|
└── src/
    ├── app/
    │   ├── api/           # [Frontend API] Folder for Next.js API Routes
    │   │   ├── detect-barcode/ # API to forward barcode detection requests to the Python Backend
    │   │   └── products/     # APIs for searching and managing product data
    │   ├── globals.css     # [Style] Main global CSS file for the project
    │   ├── layout.tsx      # [Layout] The main layout structure for all web pages
    │   └── page.tsx        # [Page] The primary page that assembles all components for display
    |
    ├── components/       # [UI] Folder for all reusable UI Components
    │   ├── activity/      # Components related to displaying "Recent Activity"
    │   ├── auth/          # Components for user authentication (Login)
    │   ├── camera/         # Components for the camera and video feed display
    │   ├── forms/          # Form components, like the "Add New Product" form
    │   ├── headers/        # Application header components
    │   ├── inventory/     # Components for displaying and managing inventory
    │   ├── layout/         # Layout structure components for different views
    │   ├── modals/         # Modal components, such as the logout confirmation
    │   └── product/        # Components for displaying product information
    |
    ├── data/             # [Data] Folder for managing data loading and processing from the CSV file
    │   ├── loaders/        # Code for loading the CSV file
    │   ├── services/       # Code for searching and managing product data
    │   └── utils/          # Helper functions for processing CSV data
    |
    ├── hooks/            # [Logic] Folder for Custom Hooks that manage the application's logic
    │   ├── useBarcodeDetection.tsx # The main hook controlling the camera, processing, and product lookup
    │   ├── useEmployeeAuth.tsx   # Hook for managing employee login and sessions
    │   ├── useInventoryManager.tsx # Hook for managing inventory state (add, remove, edit)
    │   └── ... (Other hooks for smaller tasks like canvas, product lookups)
    |
    └── types/             # [Types] Folder for defining TypeScript data structures
        ├── product.ts      # Defines the data structure for a Product
        └── detection.ts    # Defines the data structure for barcode detection results
|
└── .gitignore          # Specifies files and folders for Git to ignore
└── docker-compose.yml   # Configuration file for running the project with Docker
└── next.config.ts       # Configuration file for Next.js
└── package.json         # Lists project metadata and dependencies
└── README.md            # Documentation providing an overview of the project

```

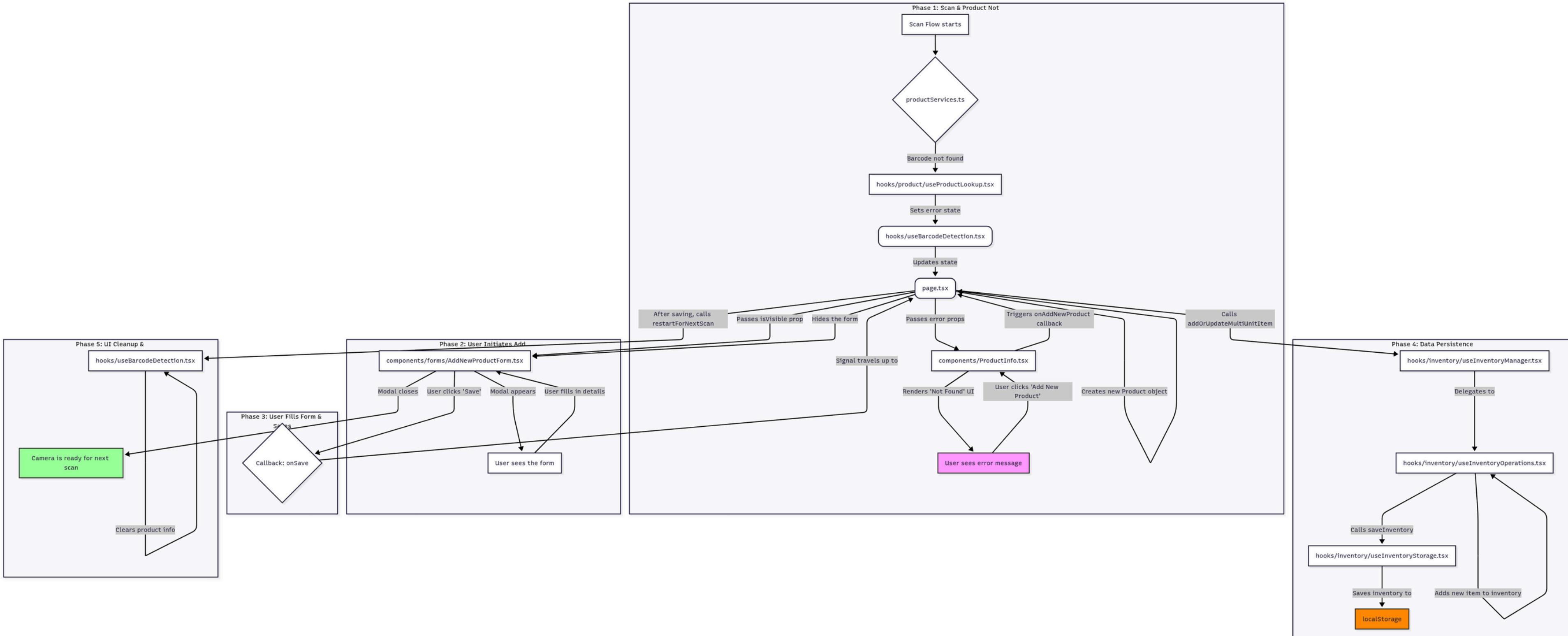
# User authentication



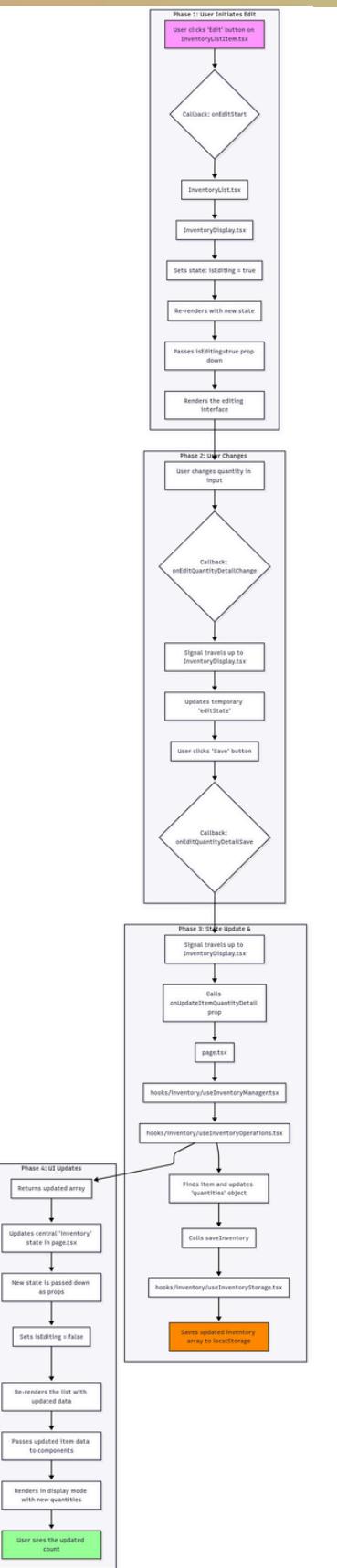
# Barcode scanning



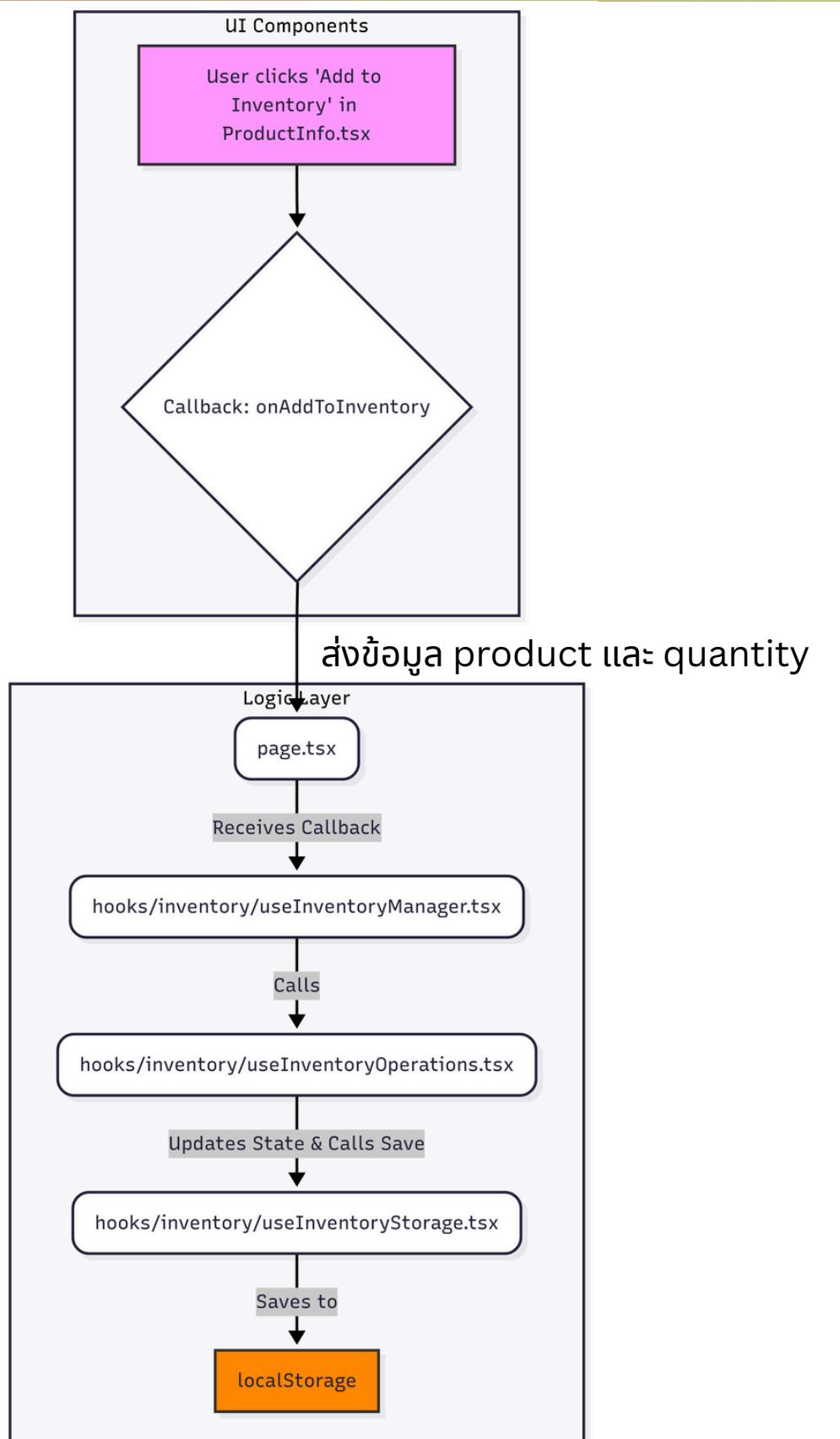
# Add new products



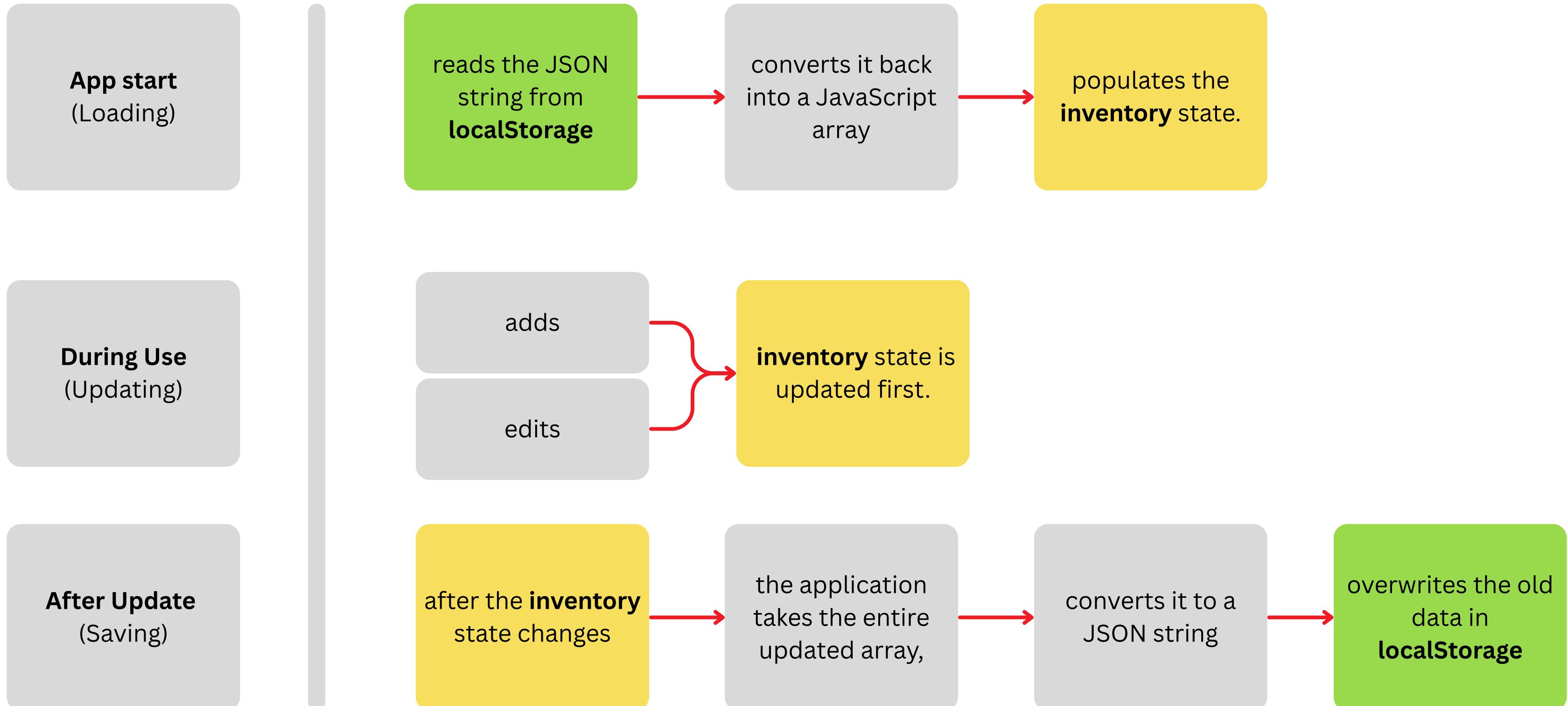
# Edit quantity



# Inventory management



# inventory VS localStorage

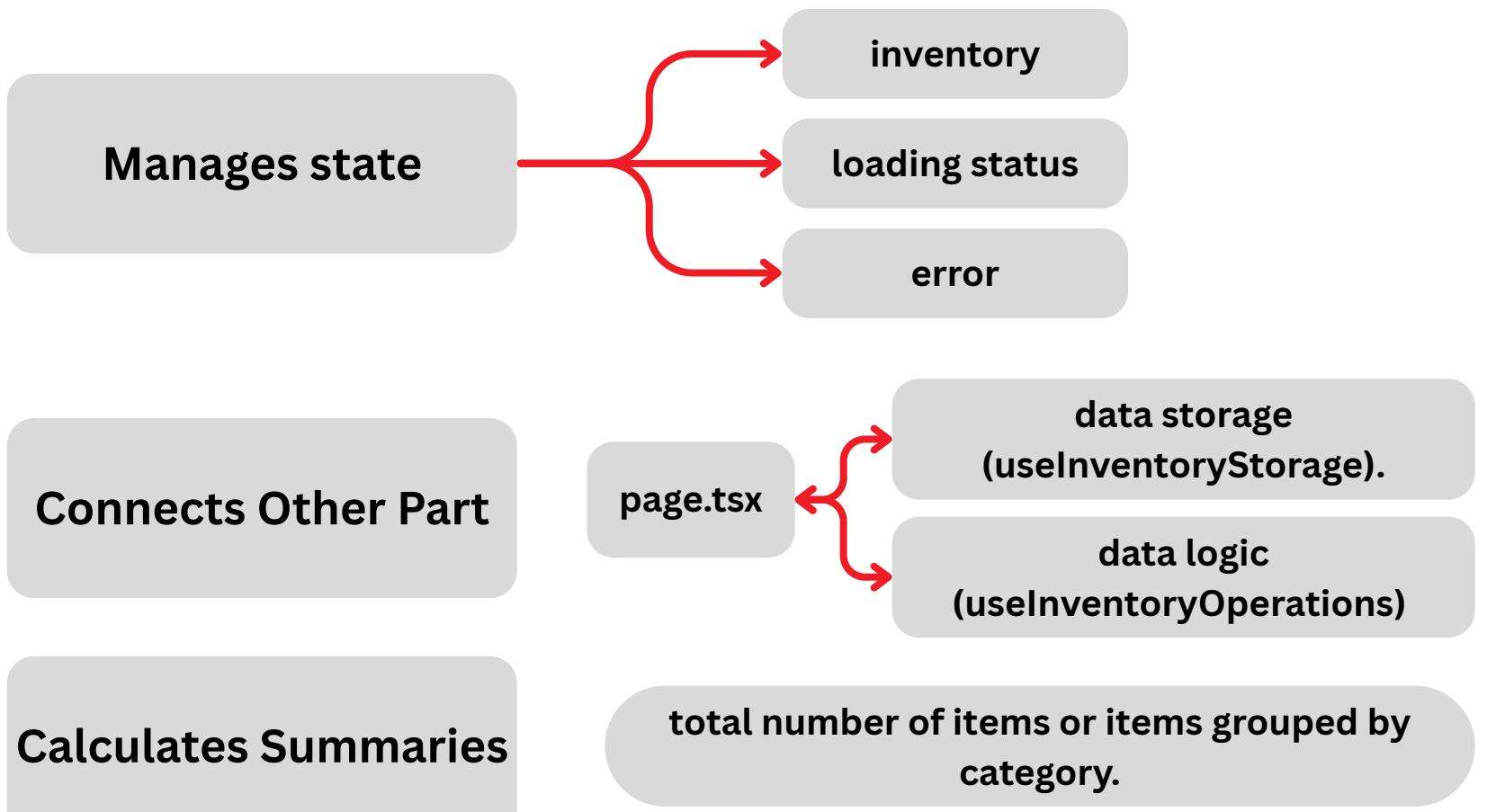


# useInventoryManager VS useInventoryOperations



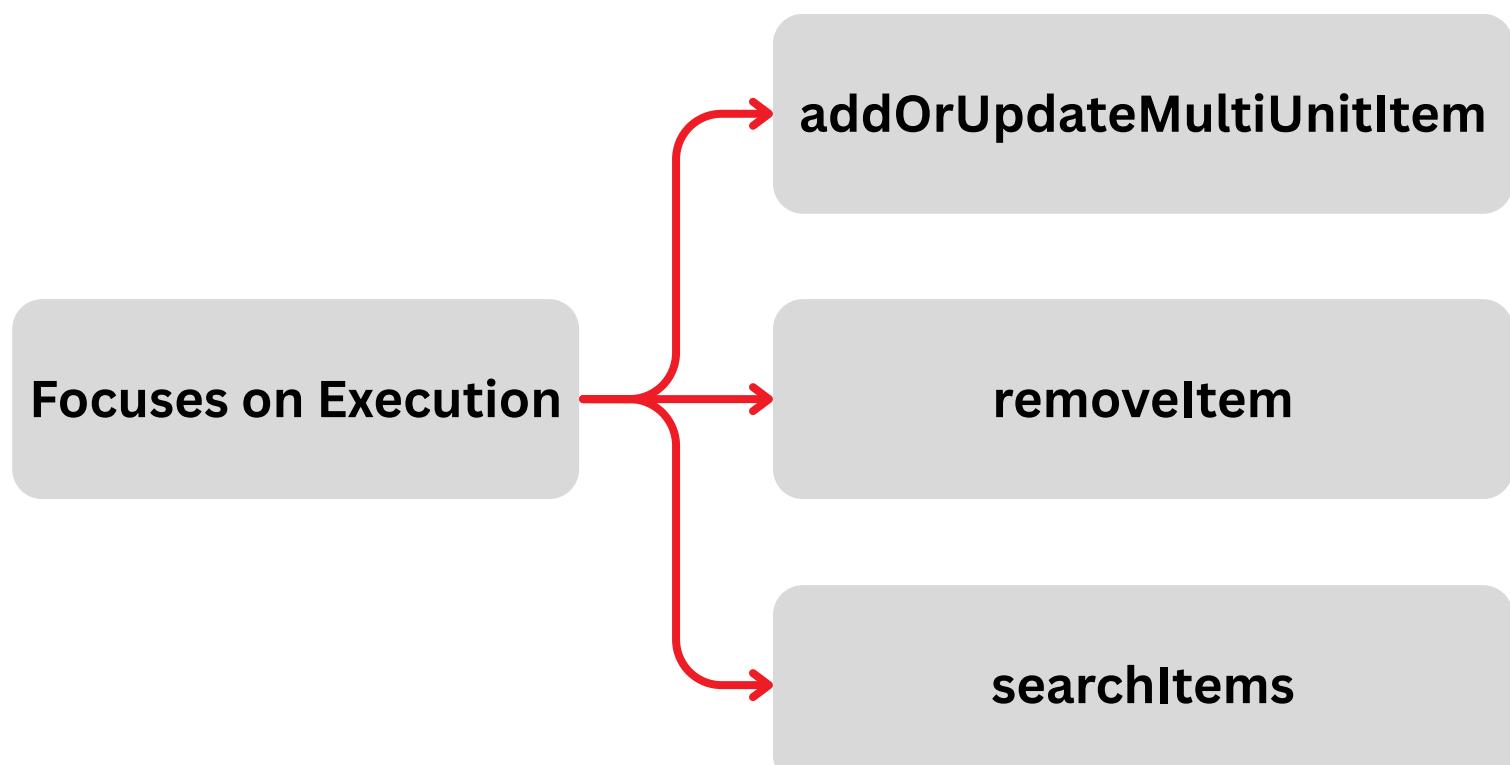
## useInventoryManager

responsible for the high-level control and state management of the entire inventory warehouse.



## useInventoryOperations

contains the specific "how-to" logic for manipulating the inventory array data.



## Product interface



```
export interface InventoryItem {
  id: string;

  // ✅ Product identification (ใช้ materialCode เป็นหลัก)
  materialCode: string; // รหัสสินค้า (สำคัญ - ใช้รวม SKU)
  productName: string;
  brand: string;
  category: string;
  size: string;
  unit: string;

  // ✅ NEW: Multi-unit quantities (ไม่มี remainder)
  quantities: MultiUnitQuantities;

  // ✅ Metadata
  lastUpdated: string;
  productData?: Product;
  addedBy?: string;
  branchCode?: string;
  branchName?: string;
  productGroup?: string;
  thaiDescription?: string;
}
```

```
export interface MultiUnitQuantities {
  cs?: number; // สัง
  dsp?: number; // แพ็ค
  ea?: number; // ชิ้น
}
```