



SCHOOL OF INFORMATICS DEPARTMENT  
OF COMPUTER SCIENCE



TERM-III

# Green-Cycle: Intelligent Plastic Bottle Detection and Reward System

An AI-Powered Solution for Sustainable Recycling

Presenting By:  
K. Ranga Sai

External Guide:  
Dr. Mani Sarma Vittapu Sir  
Assistant Professor  
Aurora University

Under The Guidance Of:  
Dr. V Harsha Shastri Sir  
Associate Professor  
Aurora University

- - Computer vision - -



# From Pollution to Solution



From careless littering to active cleanup and recycling – every action shapes a cleaner future.



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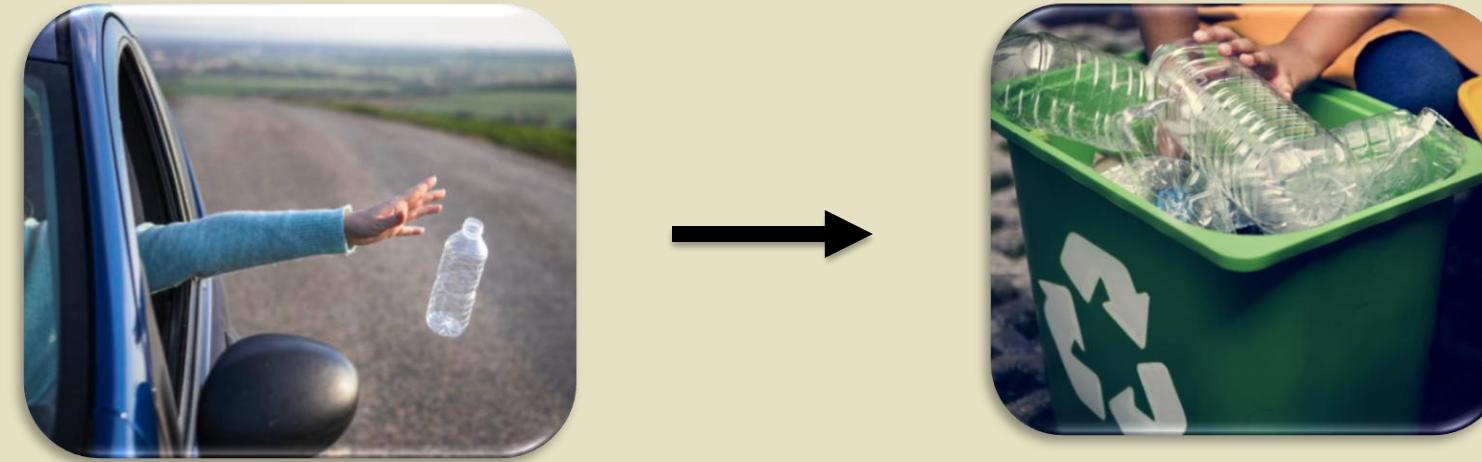
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# Abstract



Green-Cycle is an AI-powered system to make plastic bottle recycling easy and rewarding. It aims to reduce plastic waste by detecting bottles in real-time using YOLOv8, which achieves over 85% accuracy. The system uses a user-friendly Tkinter interface to show live video, bottle counts, and rewards of ₹2 per bottle. It stores session data in a SQLite database and creates charts with Matplotlib for tracking recycling trends. Text-to-speech feedback makes it accessible, and multi-threaded processing ensures smooth operation. Testing showed 86.3% accuracy, great user engagement (8/10 rating), and accurate data logging, making Green-Cycle a scalable solution for sustainable recycling.





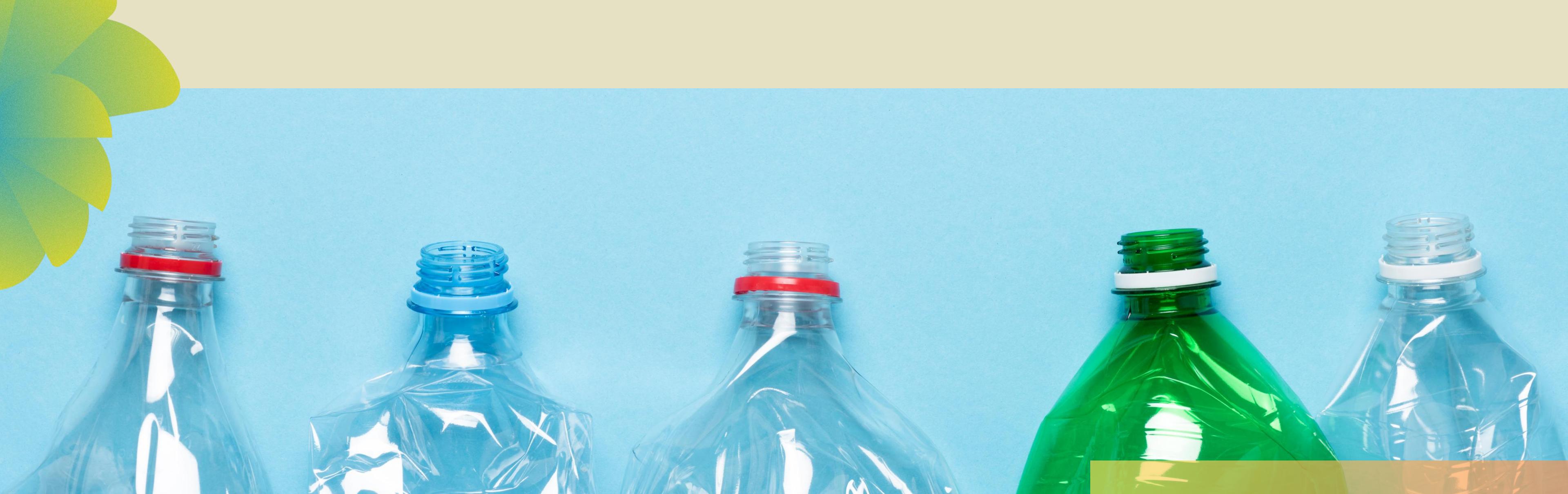
# Introduction

## Why Green-Cycle?

- Plastic waste is a big global problem (300 million tons yearly).
- Low recycling rates due to manual sorting and lack of motivation.
- Green-Cycle uses AI to detect plastic bottles and rewards users for recycling.

Goal: Make recycling easy, efficient, and rewarding.





# Objectives

## What Green-Cycle Aims to Do

- Detect plastic bottles in real-time using AI (YOLOv8).
- Provide an easy-to-use interface for users.
- Reward users (₹2 per bottle) to encourage recycling.
- Store data for tracking and analytics.
- Improve accessibility with audio feedback (TTS).



# Literature Review

## Existing Systems and Challenges

### Challenges in Existing Systems:

- Manual sorting is slow and error-prone.
- Detection struggles in complex environments (lighting, occlusions).
- Limited reward systems and accessibility features (e.g., no TTS).
- Scalability issues with single-camera setups and databases.

### Green-Cycle's Advantage:

- Uses YOLOv8 for accurate, real-time detection (86.3% accuracy).
- Offers ₹2-per-bottle rewards to motivate recycling.
- Includes Tkinter GUI and TTS for user-friendly experience.
- Supports analytics and potential multi-waste detection.



# Tools and Technologies

## Tools Used

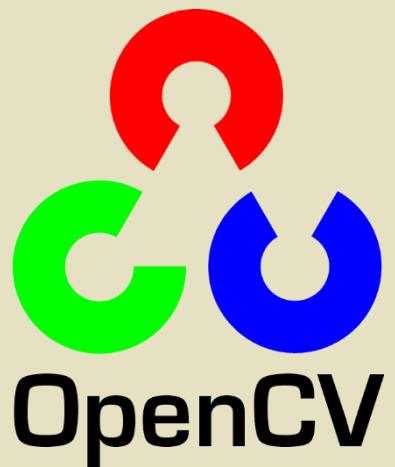
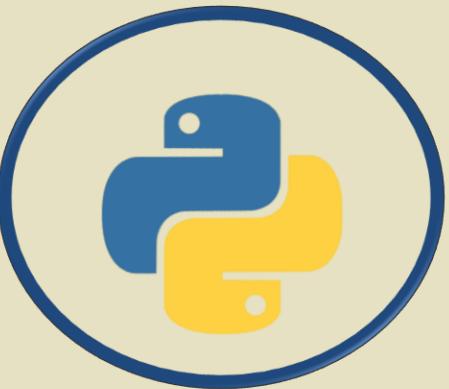
### Hardware:

Webcam, Computer (Intel i5, 8 GB RAM).

### Software:

- Python, OpenCV, YOLOv8 (Ultralytics).
- Tkinter (GUI), pyttsx3 (TTS), SQLite(database).
- Matplotlib (analytics), NumPy, Pillow.

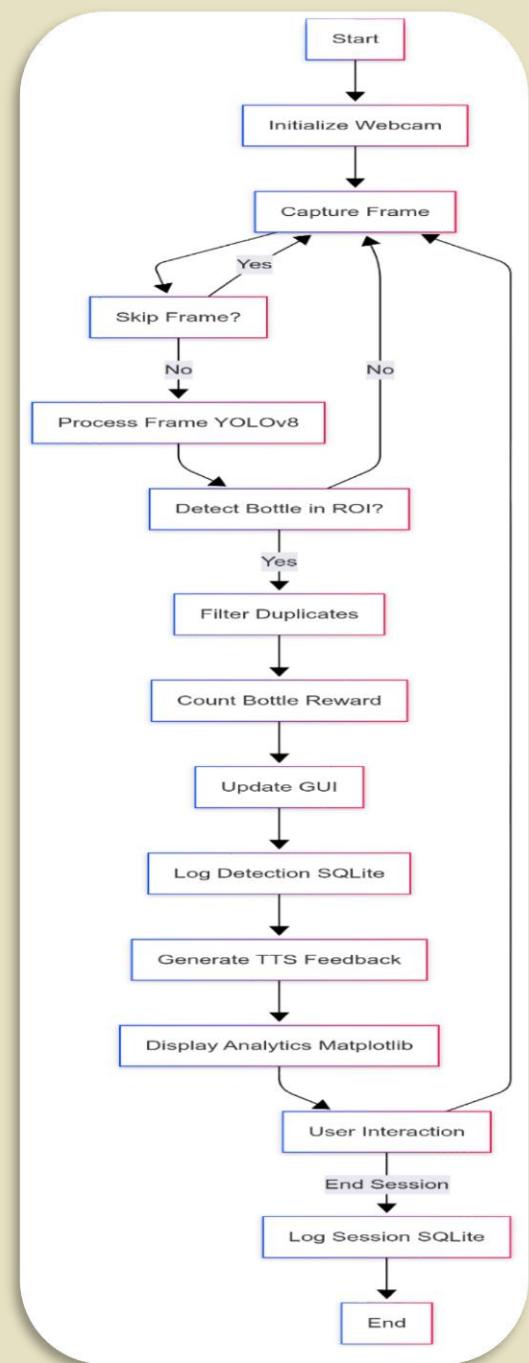
***Green-Cycle: Intelligent Plastic Bottle  
Detection and Reward System***



# Methodology

## Proposed System: How We Built It

- Capture video and process frames (OpenCV).
- Detect bottles in ROI using YOLOv8 (0.4 confidence).
- Update GUI with bottle count and rewards.
- Log data in SQLite and generate analytics.
- Use multi-threading for smooth performance.

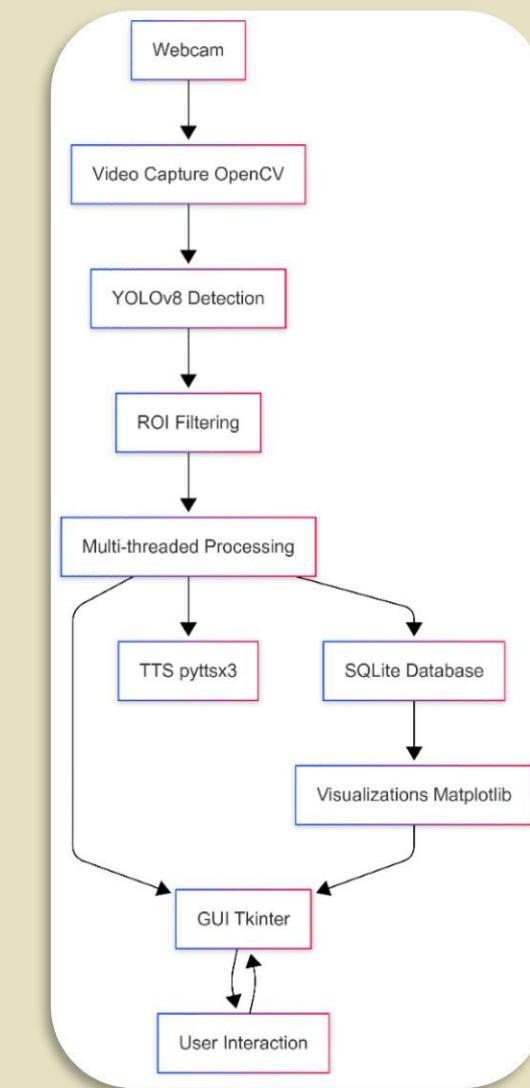


Flow Diagram

# System Overview

## How Green-Cycle Works

- Captures video using a webcam.
- Detects bottles with YOLOv8 in a specific area (ROI).
- Shows live feed and stats on a GUI (Tkinter).
- Logs data (bottle count, rewards) in SQLite.
- Gives audio feedback using TTS.

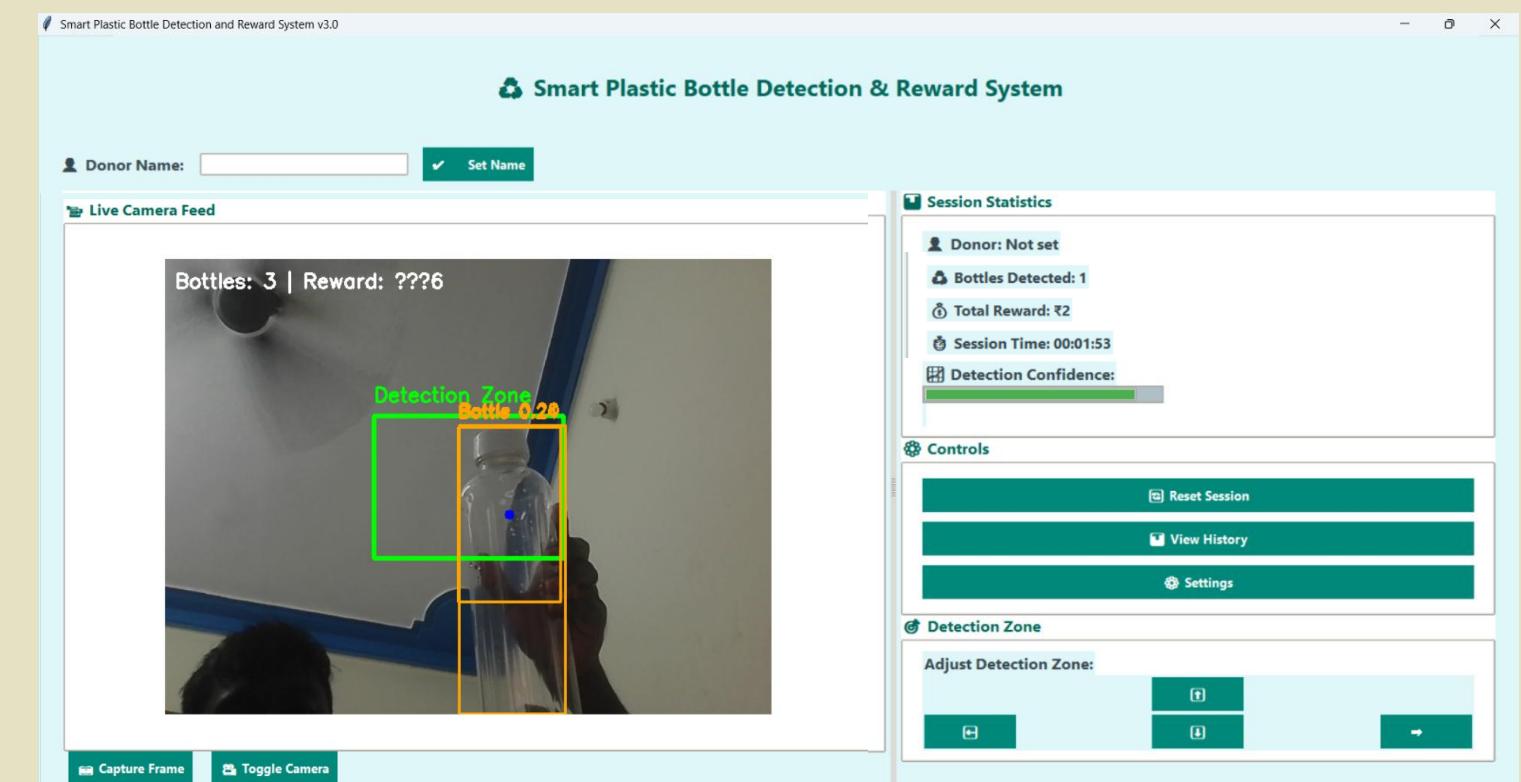


Block Diagram

# Features of Green-Cycle

## Key Features

- Real-time bottle detection (>85% accuracy).
- User-friendly GUI for live feed and stats.
- Reward system: ₹2 per bottle detected.
- Audio feedback for accessibility.
- Data logging and analytics for tracking recycling.



# Implementation

**Environment Setup:** Installed Python, OpenCV, YOLOv8, Tkinter, and other tools to create the system.

**Webcam Setup:** Connected a webcam to capture live video at 640x480 resolution and 30 FPS.

**AI Integration:** Used YOLOv8 AI model to detect plastic bottles with 85%+ accuracy.

**GUI Creation:** Built a user-friendly interface with Tkinter to show video, stats, and controls.

**Database:** Set up SQLite to store donor names, bottle counts, and rewards for tracking.



# Implementation

**Voice Feedback:** Added text-to-speech (pyttsx3) to announce bottle detections and rewards.

**Multi-threading:** Used separate threads for smooth video, GUI, and audio performance.

**Testing:** Tested in real-world settings, fine-tuned settings like ROI size and reward rate ( $\text{₹}2/\text{bottle}$ ).

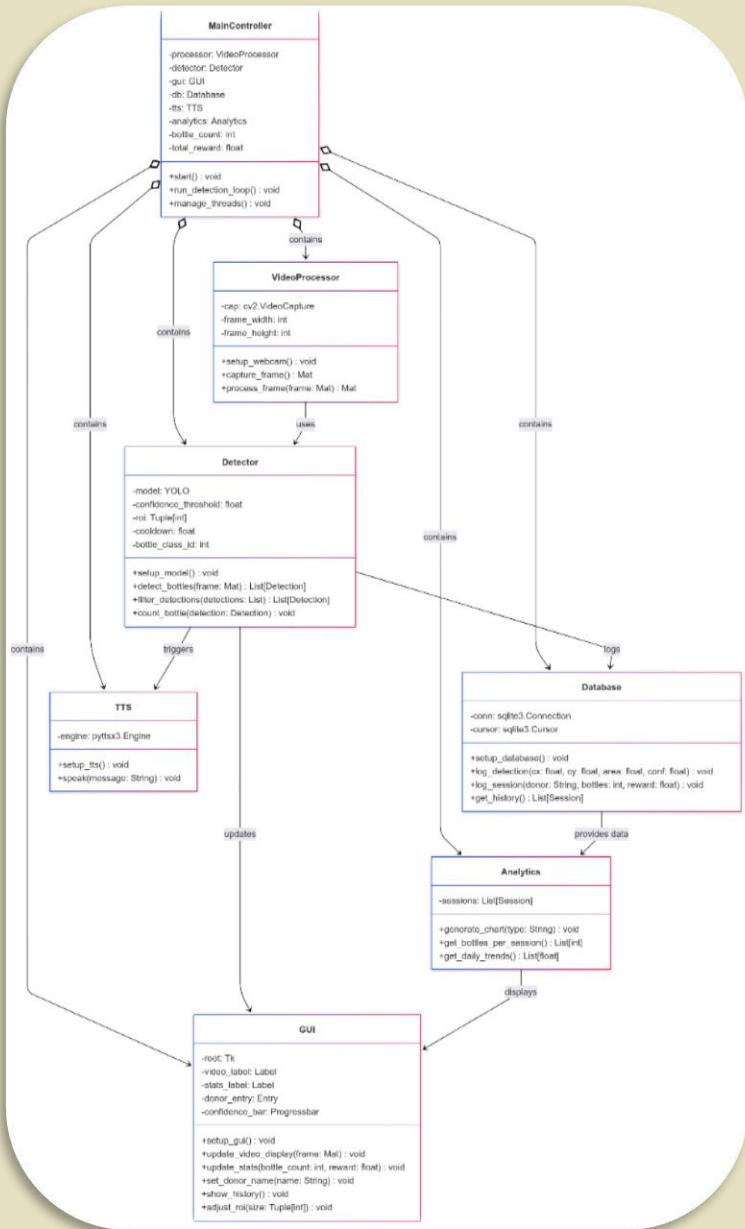
**Analytics:** Created charts with Matplotlib to show bottle detection trends.



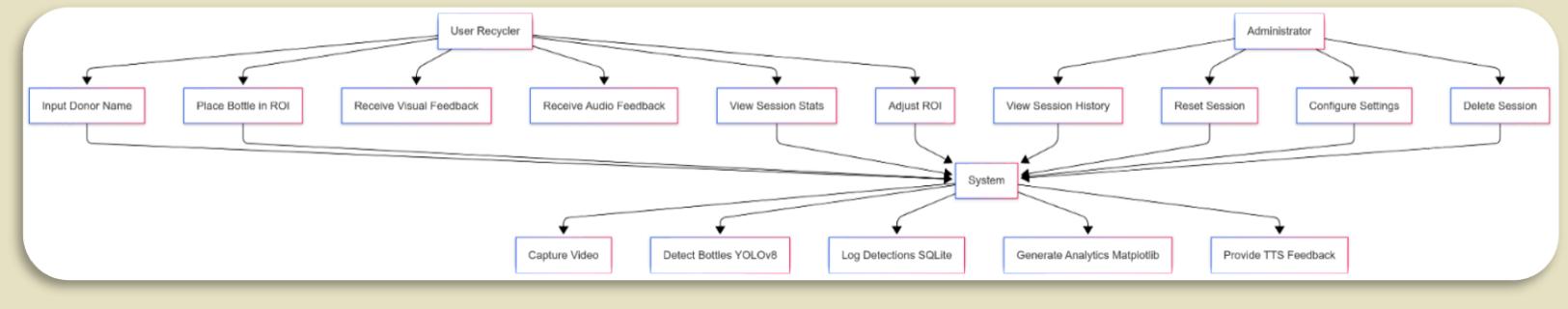
# Implementation

## Project Design

### UML Diagram



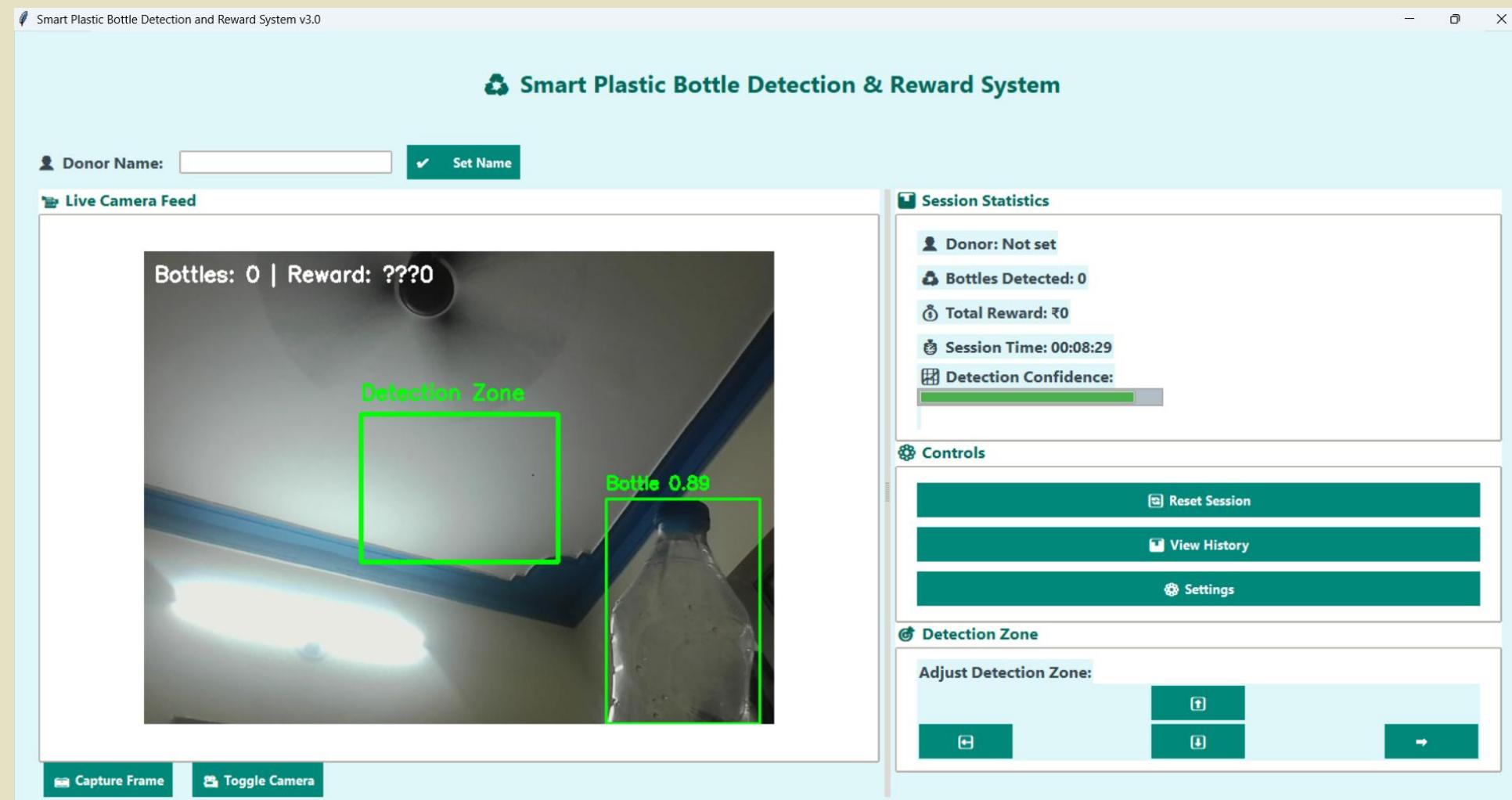
### Use Case Diagram



# Result

## Main GUI Screen:

Displays a 640x480 video feed with a green ROI rectangle (200x150 pixels) and annotations (e.g., "Bottle 0.89" for confidence score).

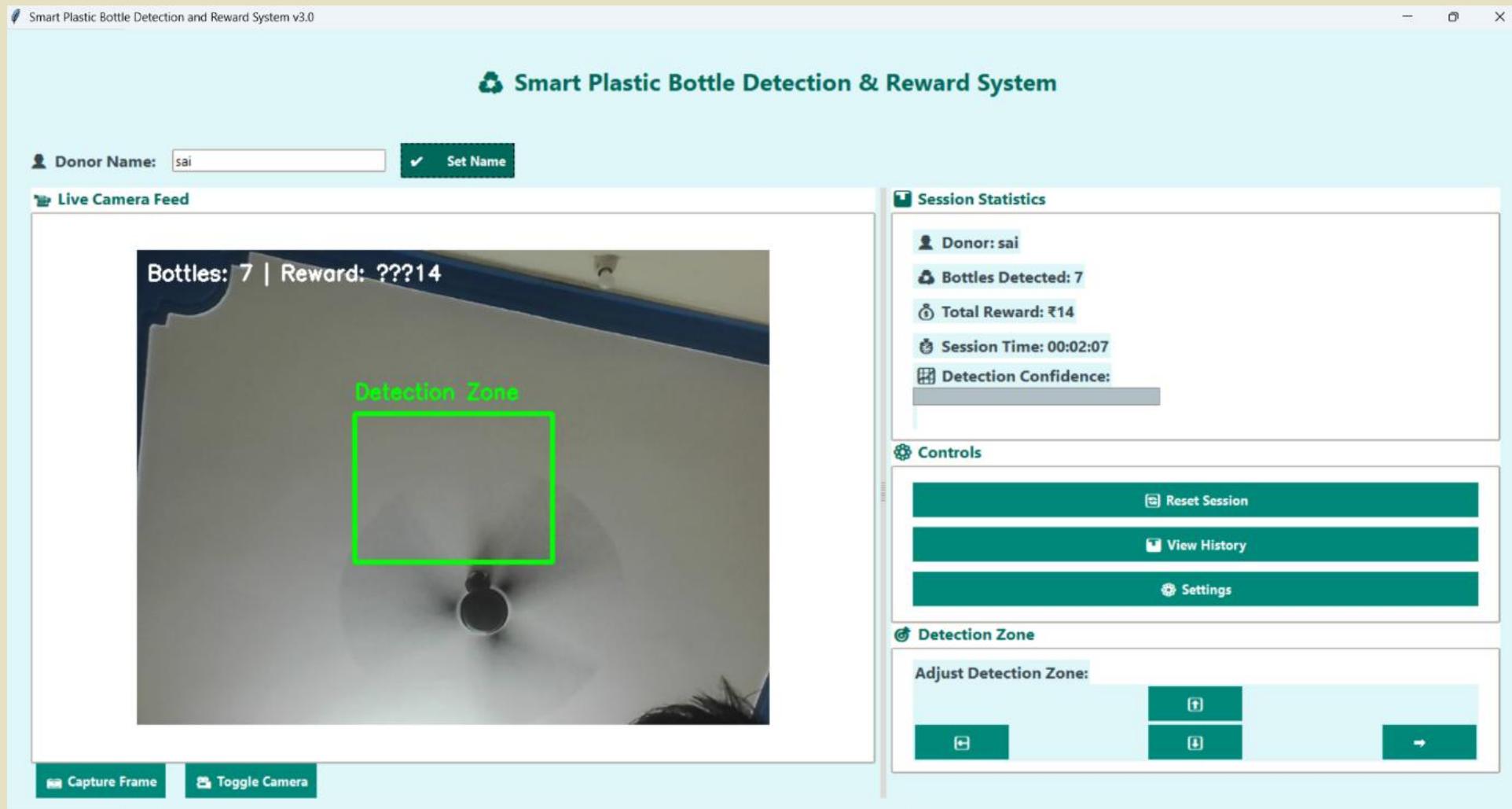


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# Result

## Main GUI Screen:

Shows session stats: "Donor: Sai," "Bottles Detected: 7," "Total Reward: ₹14," "Session Time: 00:02:07," and a confidence progress bar (86%).



# Result

## History Window:

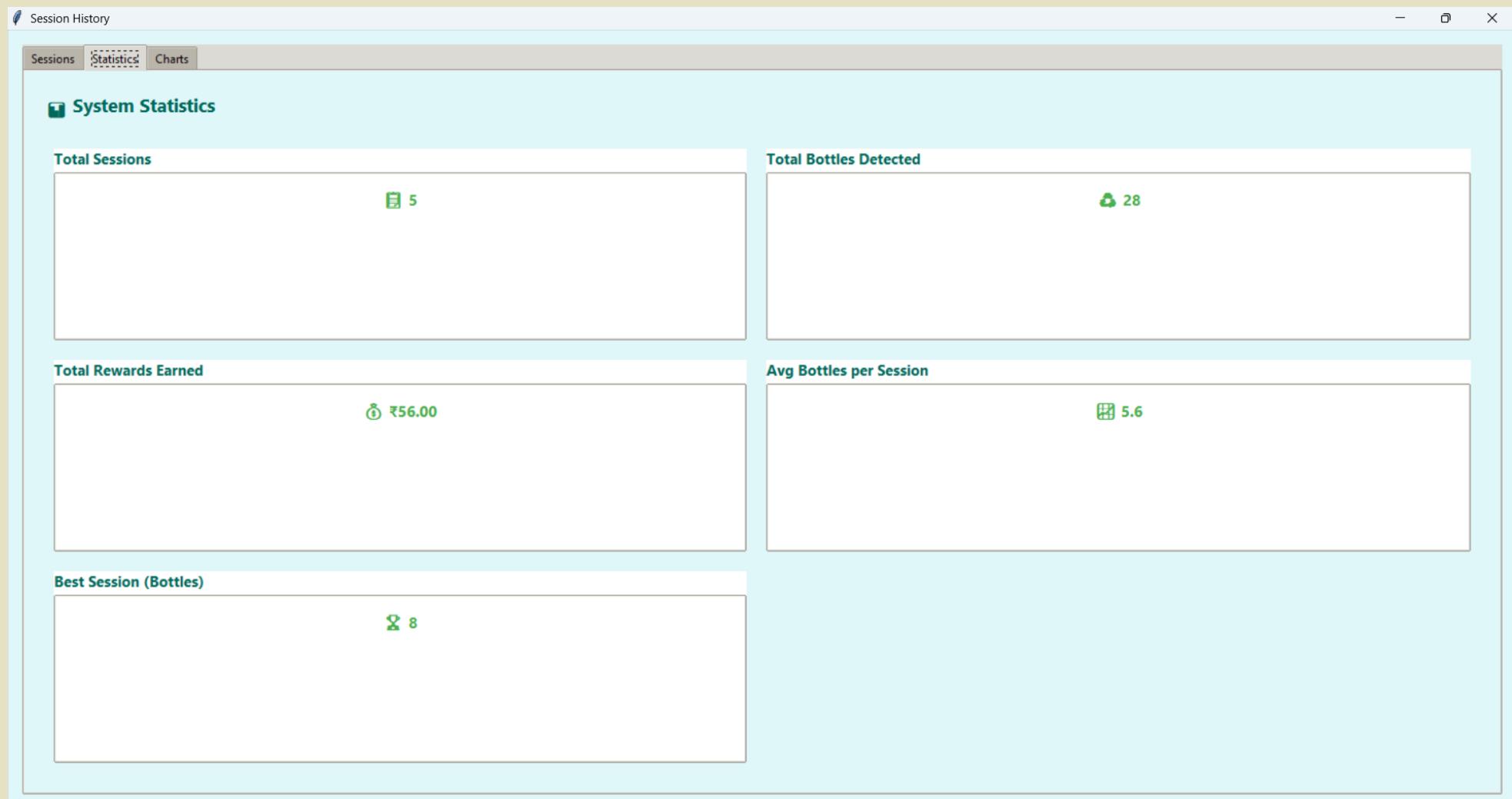
Features a Treeview table listing sessions (e.g., ID: 5, Donor: Sai, Start: 2025-07-12 15:39:04, Bottles: 7, Reward: ₹14).

Session ID	Donor Name	Start Time	End Time	Bottles Detected	Total Reward (₹)
5	sai	2025-07-12 15:39:04	2025-07-12 15:43:12	7	14.0
4	Unknown	2025-07-12 11:24:38	2025-07-12 11:28:15	4	8.0
3	Ram	2025-07-12 10:40:52	2025-07-12 10:42:49	7	14.0
2	shiva	2025-07-12 10:39:59	2025-07-12 10:40:41	2	4.0
1	hari	2025-07-12 10:36:57	2025-07-12 10:39:48	8	16.0

# Result

## History Window:

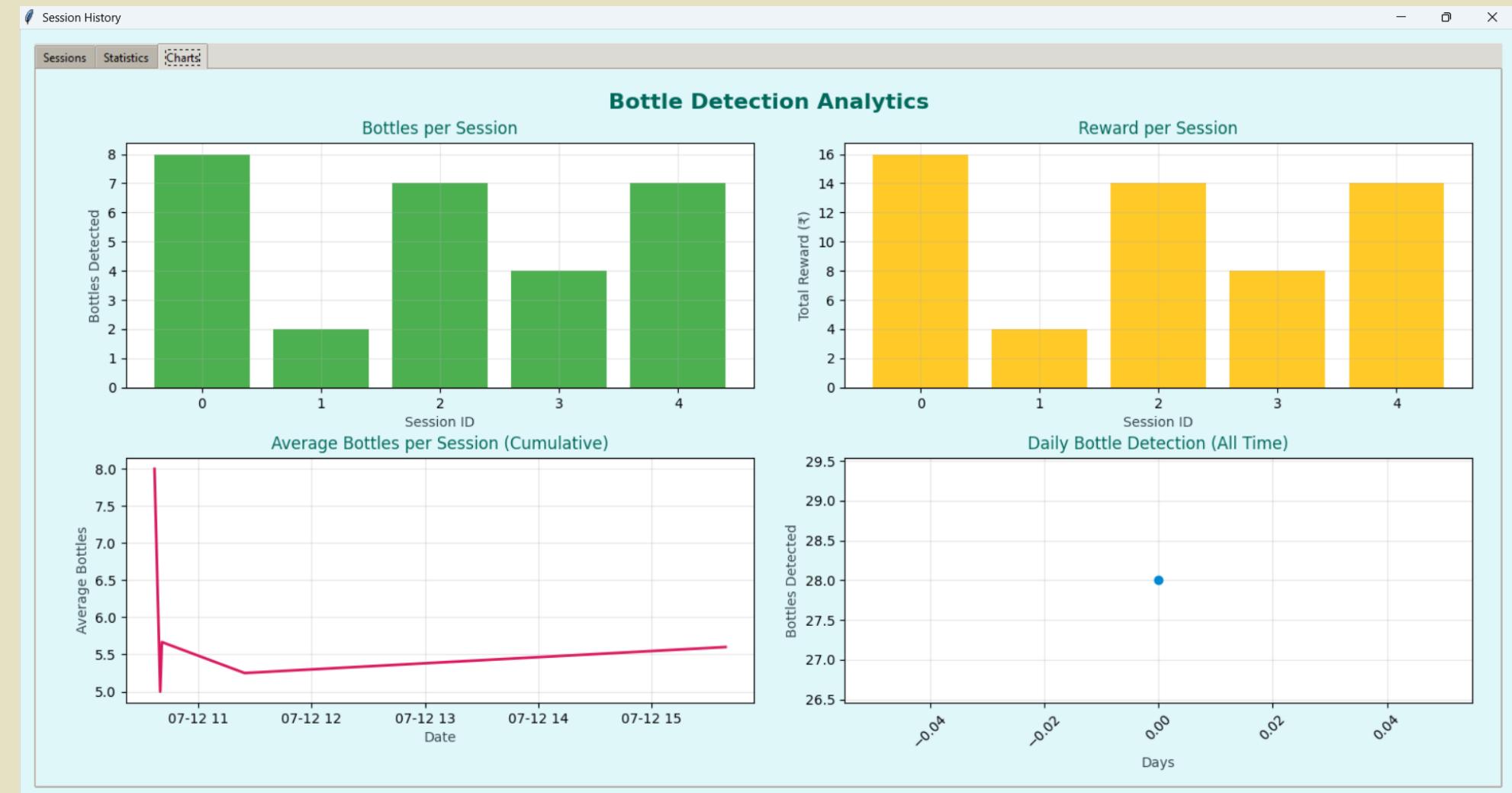
Statistics combining all sessions all we can see at one place.



# Result

## History Window:

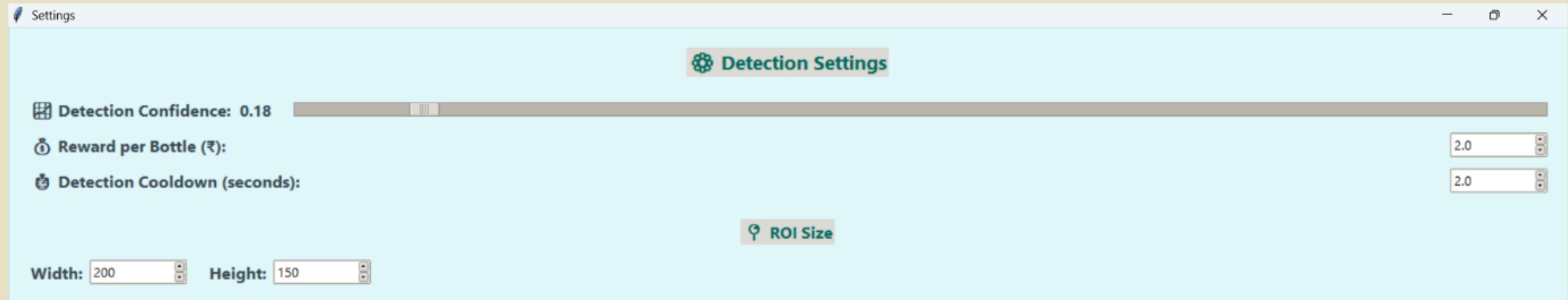
Displays Matplotlib charts: a bar chart of bottles per session and a line plot of daily bottle trends.



# Result

## Settings Window:

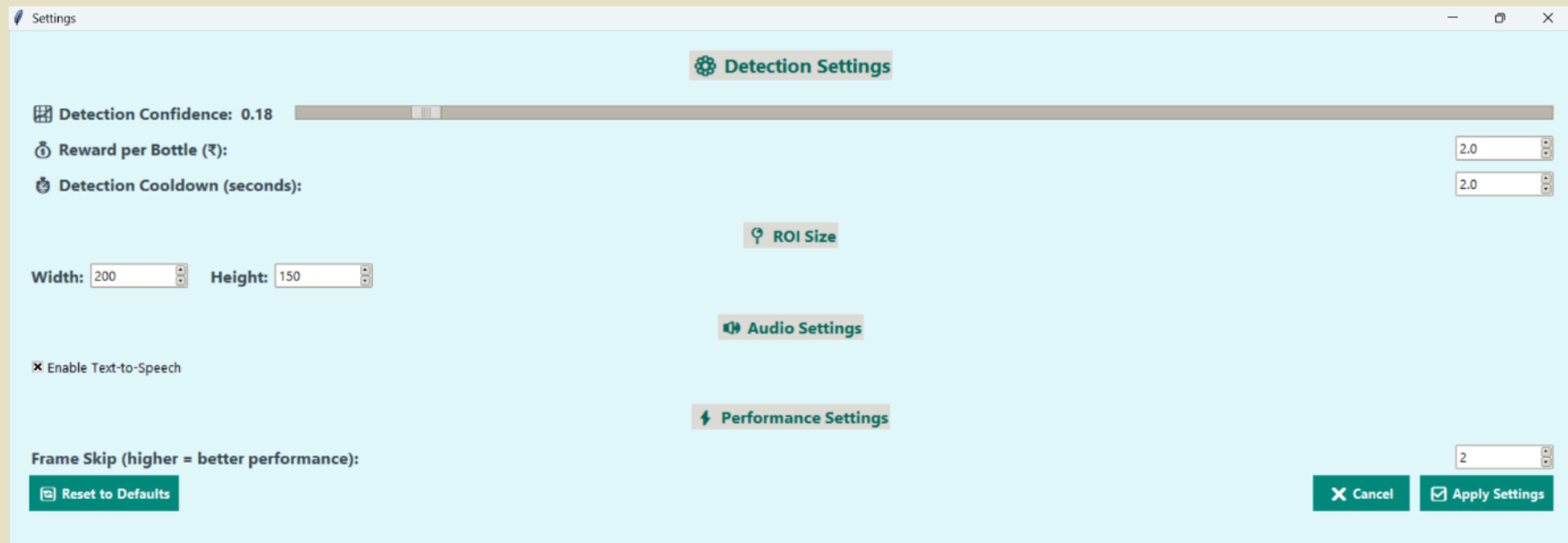
Shows sliders for detection confidence (0.18), spinboxes for reward rate (₹2), ROI size (200x150), and a checkbox for TTS (enabled).



# Result

## Settings Window:

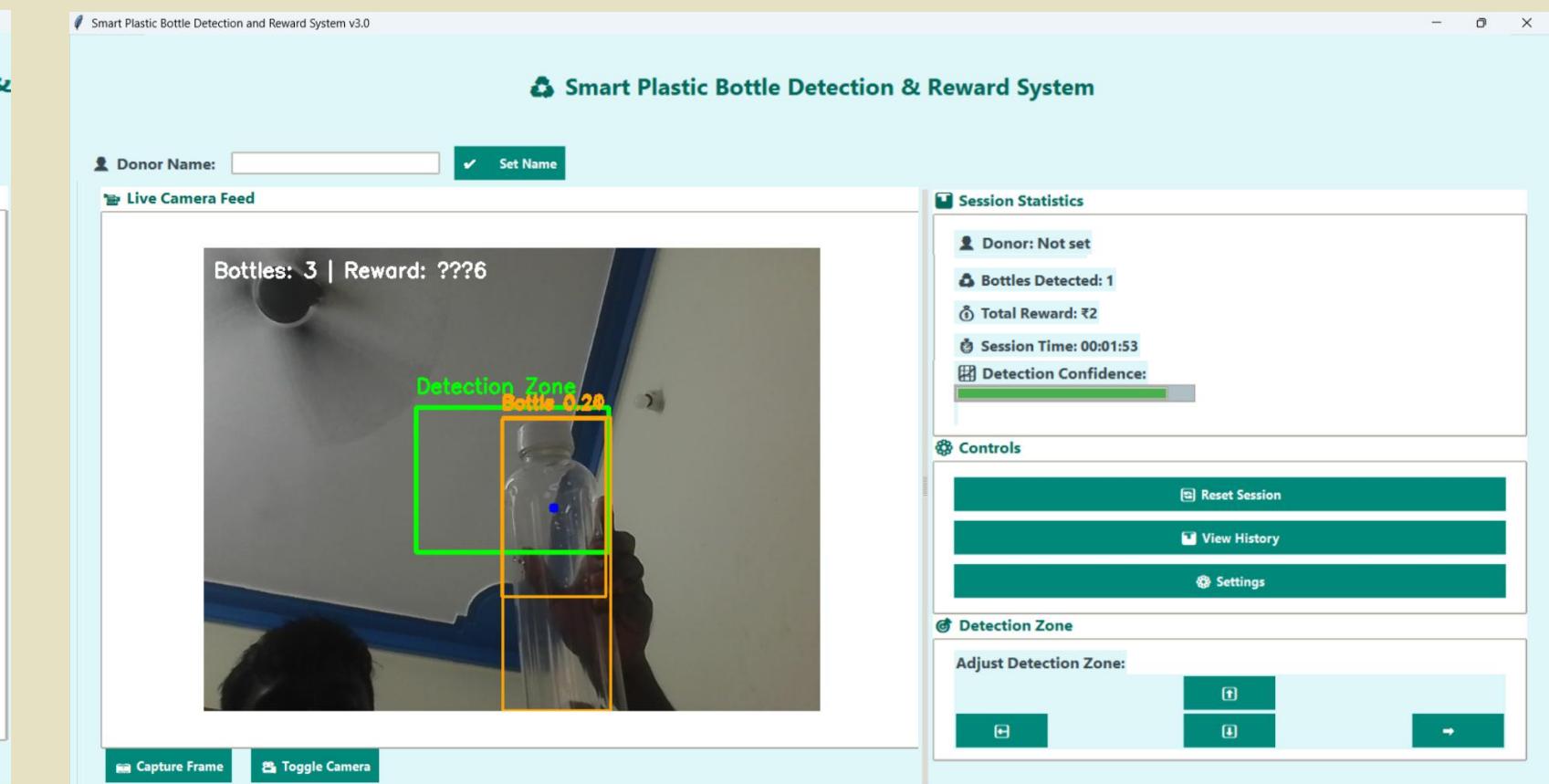
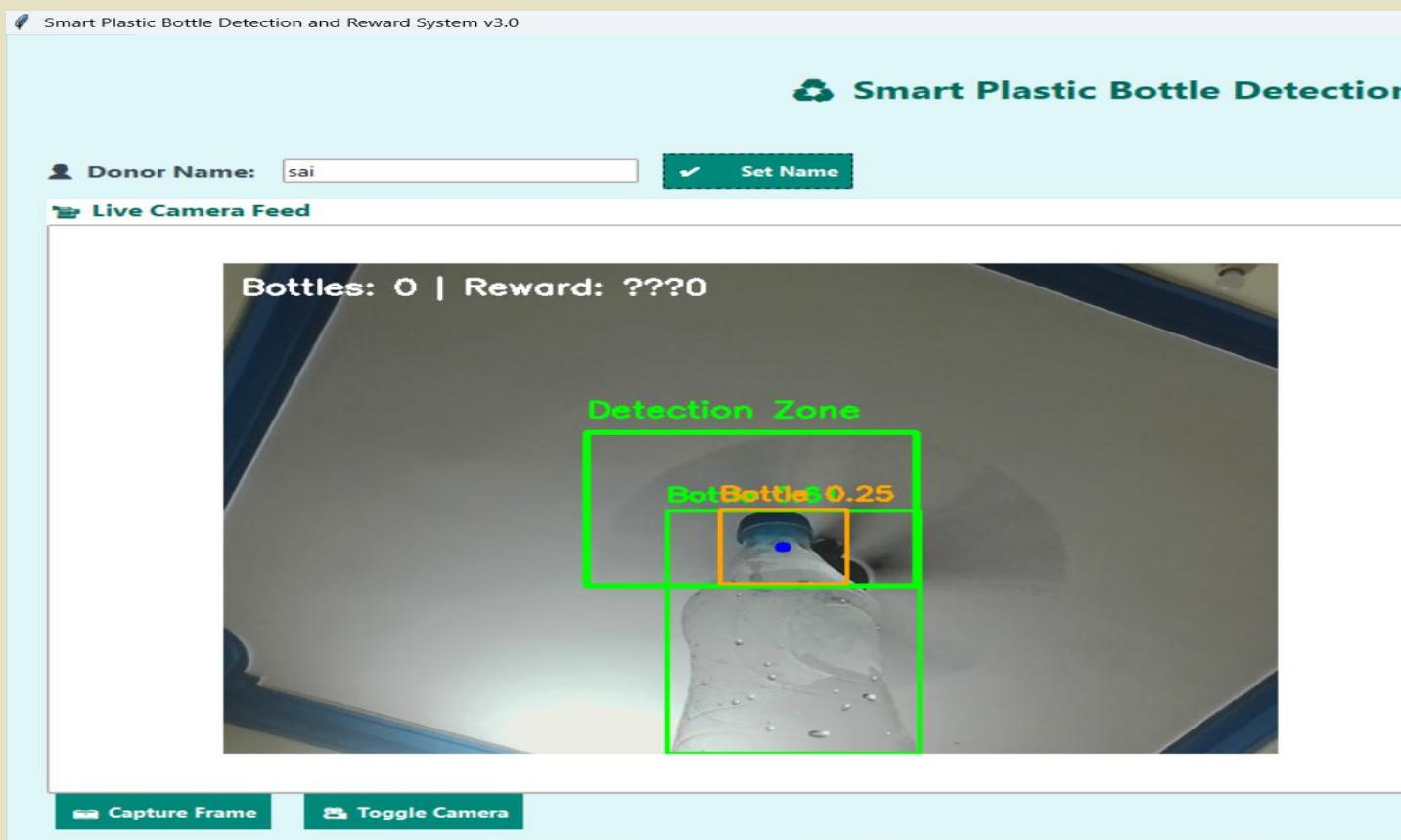
Includes buttons for “Apply Settings,” “Cancel,” and “Reset to Defaults.”



# Result

## Final Result

These results validate Green-Cycle's ability to detect plastic bottles accurately, engage users, and manage data effectively, with minor limitations in dynamic environments that can be addressed in future iterations.



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# Community Impact

## Helping Society

- Encourages recycling with rewards.
- Reduces plastic waste in communities.
- Provides data for better waste management.
- User feedback: “Rewards motivated me to recycle more.”



# Creativity and Innovation

## What Makes Green-Cycle Unique

- Uses advanced YOLOv8 for accurate detection.
- Combines GUI, TTS, and rewards for user engagement.
- Unlike manual sorting, automates the process.
- Supports analytics for smarter recycling.



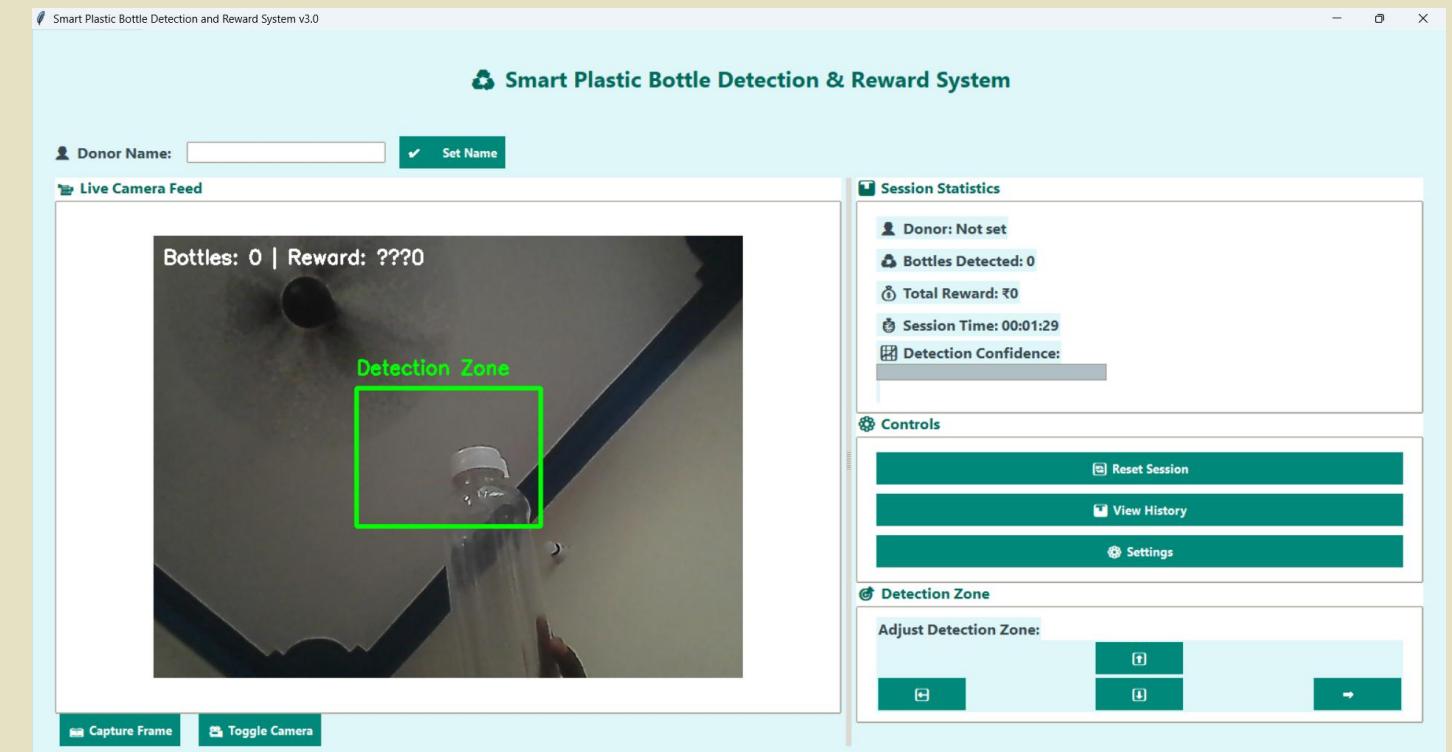
A large field of solar panels is shown from a low angle, stretching into the distance under a sky filled with orange and yellow clouds at sunset. The panels reflect the warm light of the setting sun.

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# Limitations

## Challenges Faced

- Works best in controlled lighting.
- Struggles with fast-moving bottles (70% accuracy).
- TTS less clear in noisy environments.
- Limited to single webcam and plastic bottles.



# Future Improvements

## What's Next for Green-Cycle

- Add multilingual TTS for accessibility.
- Improve detection in outdoor settings.
- Support multiple cameras or smart bins.
- Include other waste types (e.g., glass, metal).
- Add cloud storage for data sharing.





# CONCLUSION



**ZERO WASTE**

- Green-Cycle automates plastic bottle recycling with AI.
- Achieves high accuracy (86.3%) and user satisfaction.
- Promotes sustainable behavior with rewards.
- Ready for real-world use with future potential.





# References

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# THANK YOU

Looking forward to making a  
healthier life together!



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