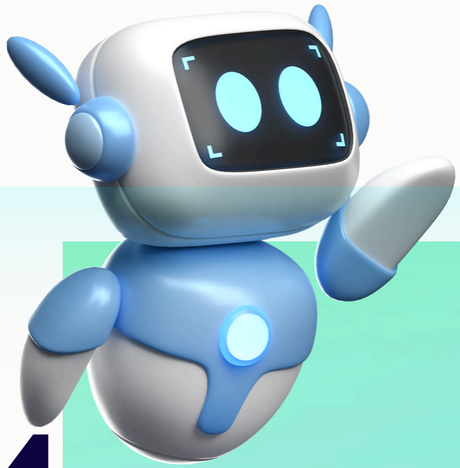
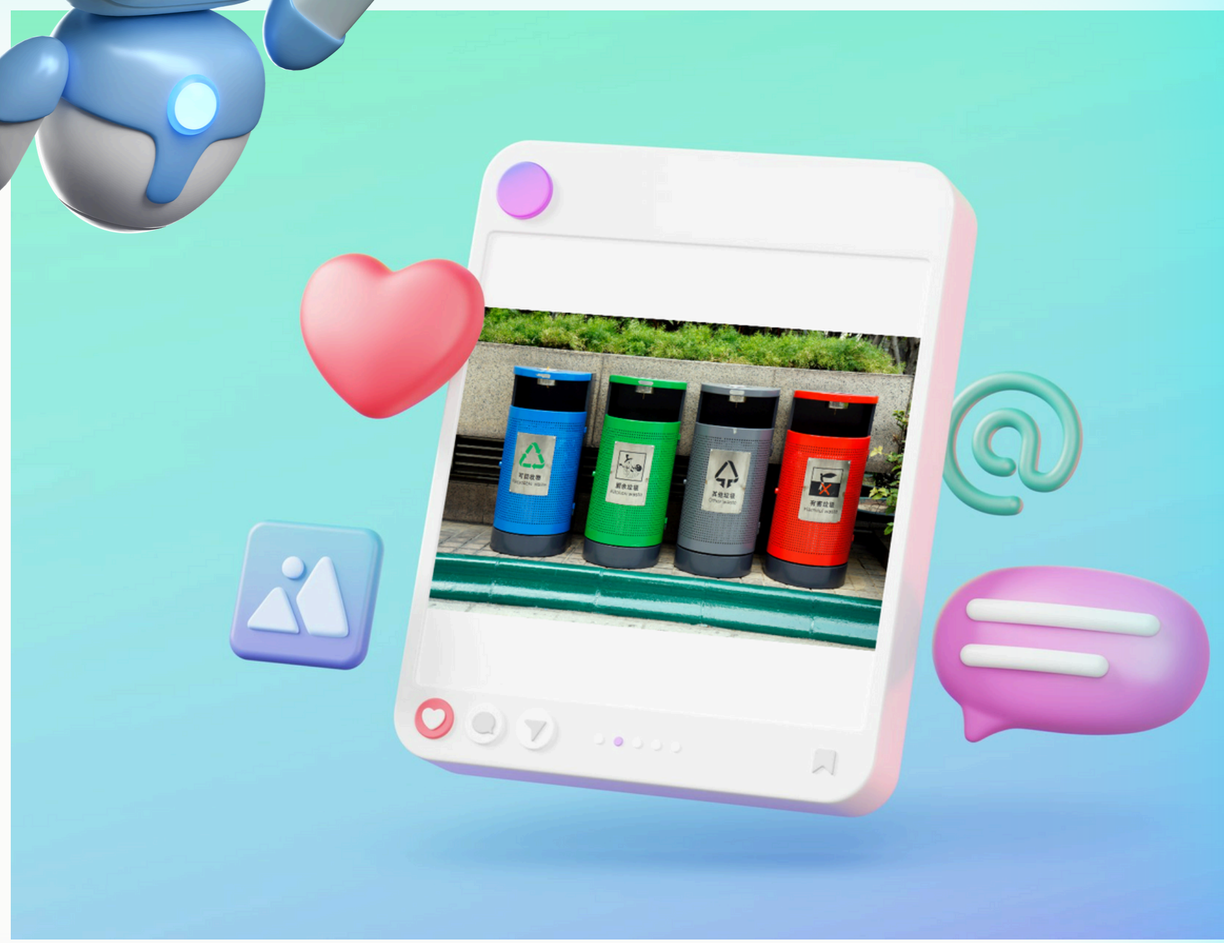
IOT-ENABLED

TRASHCAM

A Vision-Based Waste Management System





INTRODUCTION

GHI PHẦN GIỚI THIỆU Ở ĐÂY

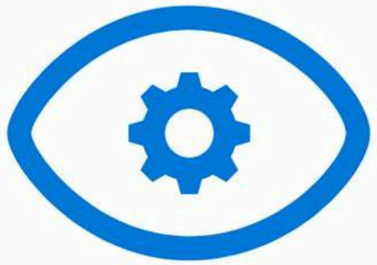
METHOD AND EXPERIMENT DETAILS

SEVICES USED

THUNKABLE

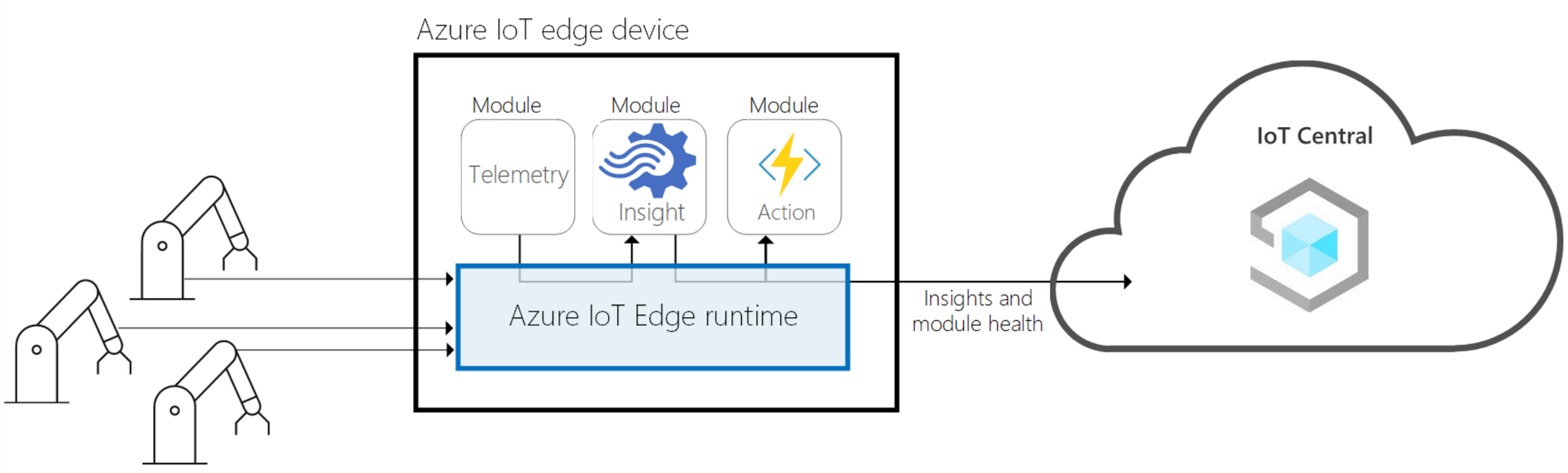
Thunkable allows users to build native mobile apps without writing any code. Thunkable provides visual representations of code through blocks, making it easy to bring app ideas to life.

AZURE CUSTOM VISION SERVICE



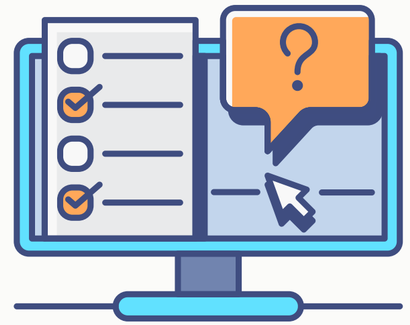
This service allows developers to quickly create intelligent applications with customizable computer vision models. Users can train Custom Vision to recognize and classify specific concepts, then integrate the models via the REST API.

AZURE IOT CENTRAL



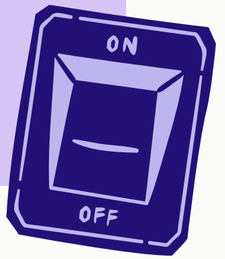
Azure IoT Central is a managed, cloud-based platform that simplifies the process of connecting, managing, and operating IoT devices. It provides an out-of-the-box solution that includes all the tools and services you need to get started with IoT without having to build the infrastructure yourself.

API AND WEB API



- API (Application Programming Interface) refers to the methods enabling communication between applications.

- Web API is the web-based implementation, typically using JSON/XML over HTTP/HTTPS to facilitate integration and data exchange, similar to a waiter relaying orders and delivering food.



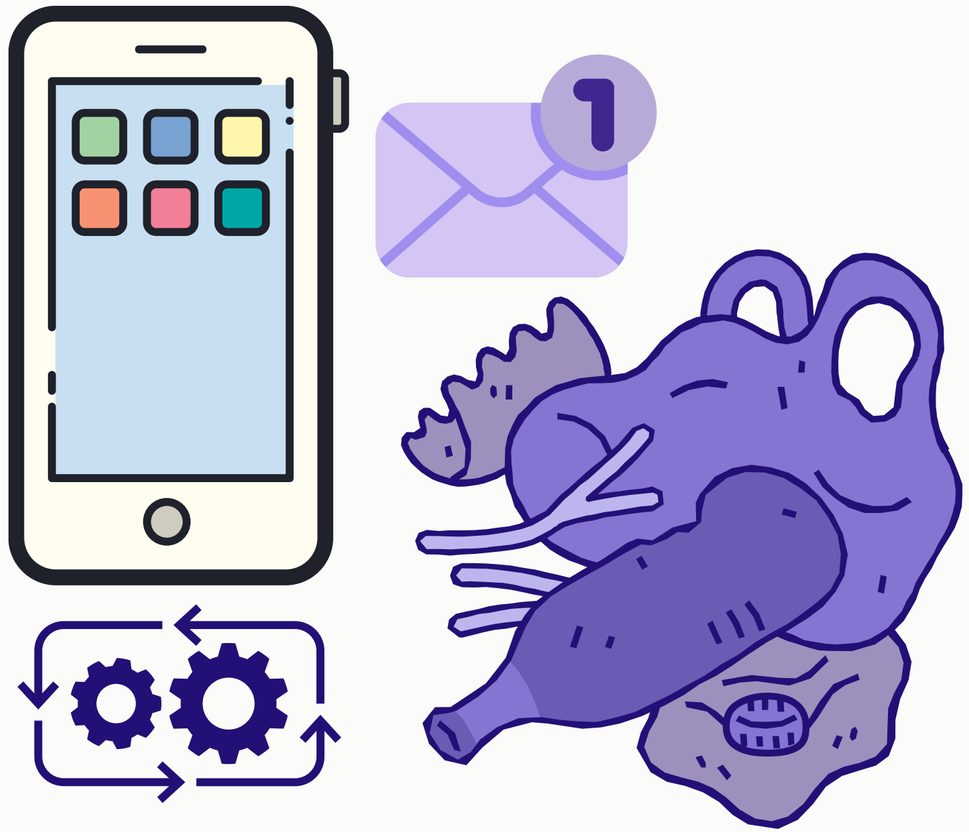
TRASHCAM: SMART WASTE MONITORING

PIONEERING INITIATIVE TO TRANSFORM WASTE MANAGEMENT THROUGH MODERN TECHNOLOGY

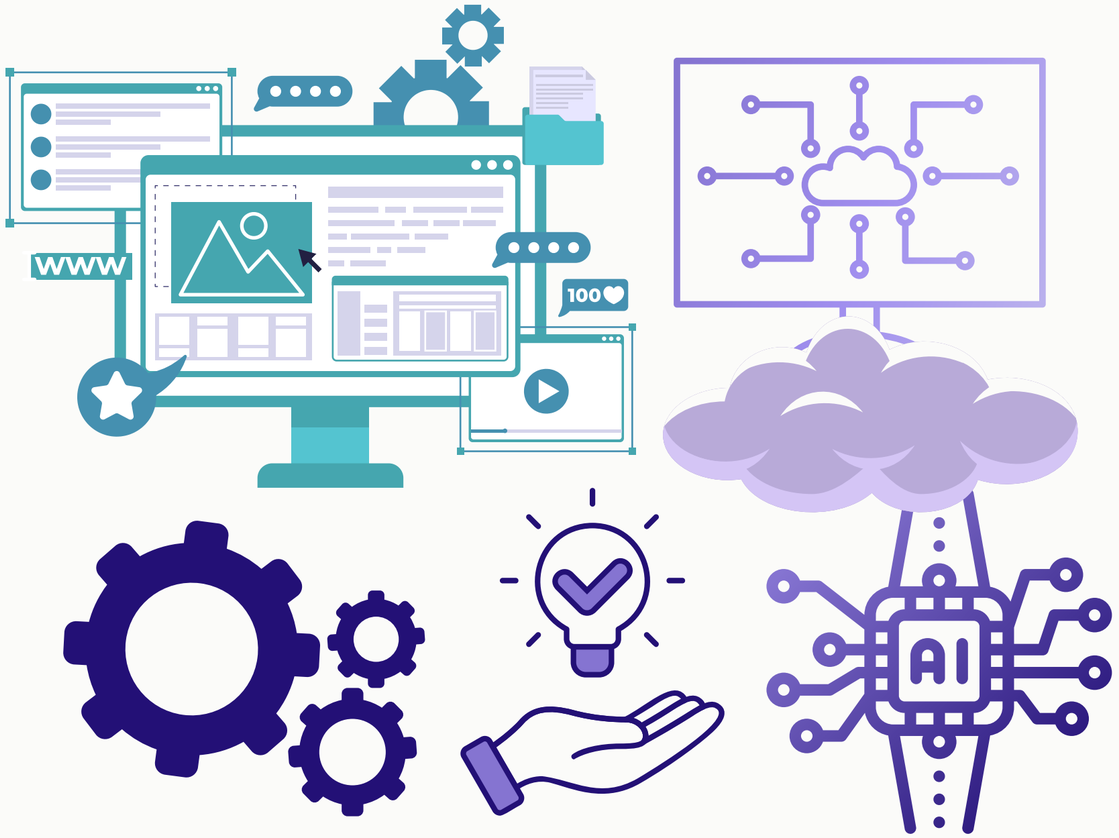
- Trash cans with cameras automatically capture images of waste
- Mobile app uses Azure Custom Vision to analyze and categorize the waste
- Provides notifications, feedback, and reminders for proper waste sorting

TRASHCAM MOBILE APPLICATION

The TrashCam mobile app receives and processes the real-time image data. It incorporates feedback mechanisms to encourage proper waste sorting, triggering notifications when improper disposal is detected.

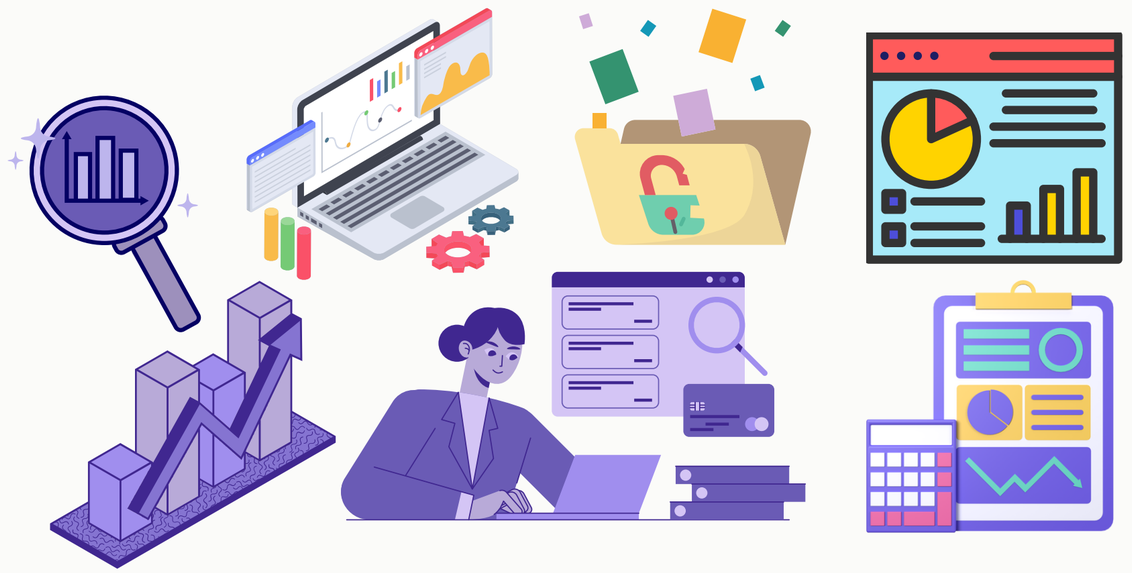


TECHNICAL FOUNDATIONS OF TRASHCAM



TrashCam integrates IoT, computer vision, and cloud services. By leveraging Azure's offerings, the project showcases the power of cloud computing to enable sophisticated, data-driven solutions.

PERFORMANCE METRICS



Accuracy is the ratio of correctly predicted positives to total positive predictions.
Recall is the ratio of correctly predicted positives to total actual positives.

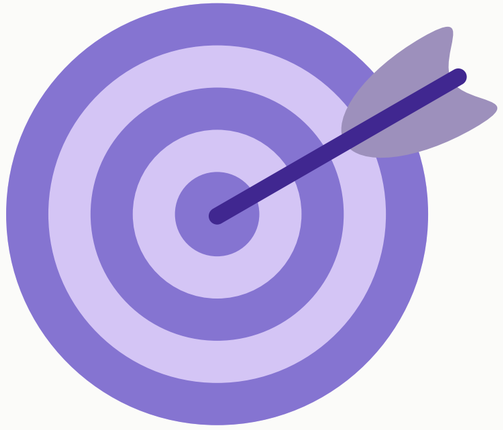
IMPORTANT STATISTICS

POSITIVE AND NEGATIVE CLASSES

In machine learning classification tasks, "positive" and "negative" describe the predicted and actual classes of data points. The positive class includes true positives (correctly predicted) and false positives (incorrectly predicted). The negative class includes true negatives (correctly non-predicted) and false negatives (incorrectly non-predicted).

Accuracy is the ratio of correctly predicted positive observations to the total number of positive predictions. It answers the question: "Out of all the objects that the model predicts as positive, how many are actually positive?"

Recall (Sensitivity) is the ratio of correctly predicted positive observations to the total number of actual positive observations.



PRECISION AND RECALL

MAP (MEAN AVERAGE PRECISION)

mAP is a common metric in object detection that combines precision and recall. It involves plotting the precision-recall curve for each class, calculating the area under the curve (average precision), and taking the mean of these values.

APP INTERFACE

type of trash can and ID

segregation status

Captured Images

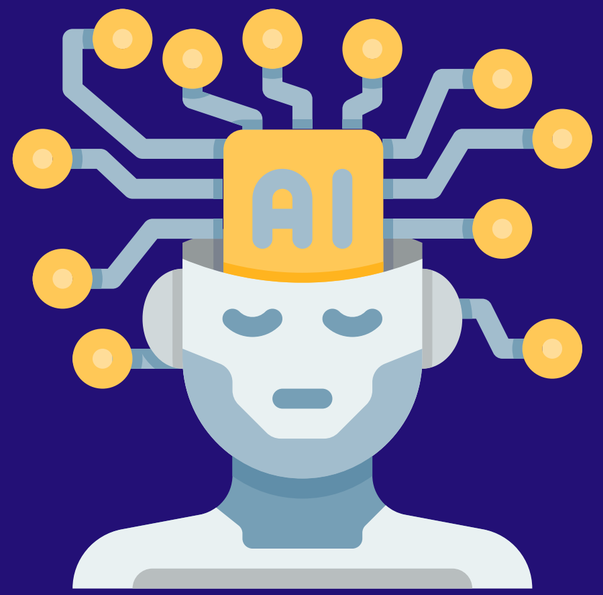
APP INTERFACE

Type of trash

Captured Images

Report wrong trash segregation

TRAINING RESULTS



Iteration 2

Finished training on **12:00:12 10/8/2024** using **General [A1]** domain
Iteration id: **9a987037-7828-42b6-a8c2-61b06b0f3a5d**
Published as: **Iteration2**

Precision	Recall	mAP
80.4%	91.8%	90.0%

STRENGTHS AND WEAKNESSES

- STRENGTHS

+ COST-EFFECTIVE AND EASY TO USE.
+ AN EDUCATIONAL TOOL FOR PROMOTING PROPER WASTE SORTING HABITS.
+ POTENTIAL TO REDUCE WASTE MANAGEMENT COSTS AND ENVIRONMENTAL IMPACTS.

- WEAKNESSES

+ ACCURACY IS DEPENDENT ON THE QUALITY AND QUANTITY OF TRAINING DATA.
+ OCCASIONAL AND MISCLASSIFICATION ERRORS MAY OCCUR.

IMPACT AND FUTURE POTENTIAL OF TRASHCAM

- Accountability and Compliance:

The visual evidence captured by TrashCam serves as a deterrent against improper waste disposal. In educational settings, for example, the system can track and report instances of incorrect sorting, fostering a culture of responsibility and promoting healthy competition among students or classrooms.

- Data-Driven Waste Management:

The data collected through TrashCam provides valuable insights into waste composition and disposal patterns. This information empowers decision-makers to optimize waste collection routes, resource allocation, and recycling programs.