

INTERACTIVE WASTE SEGREGATION BIN

AUTOMATION ENGINEERING PROGRAM

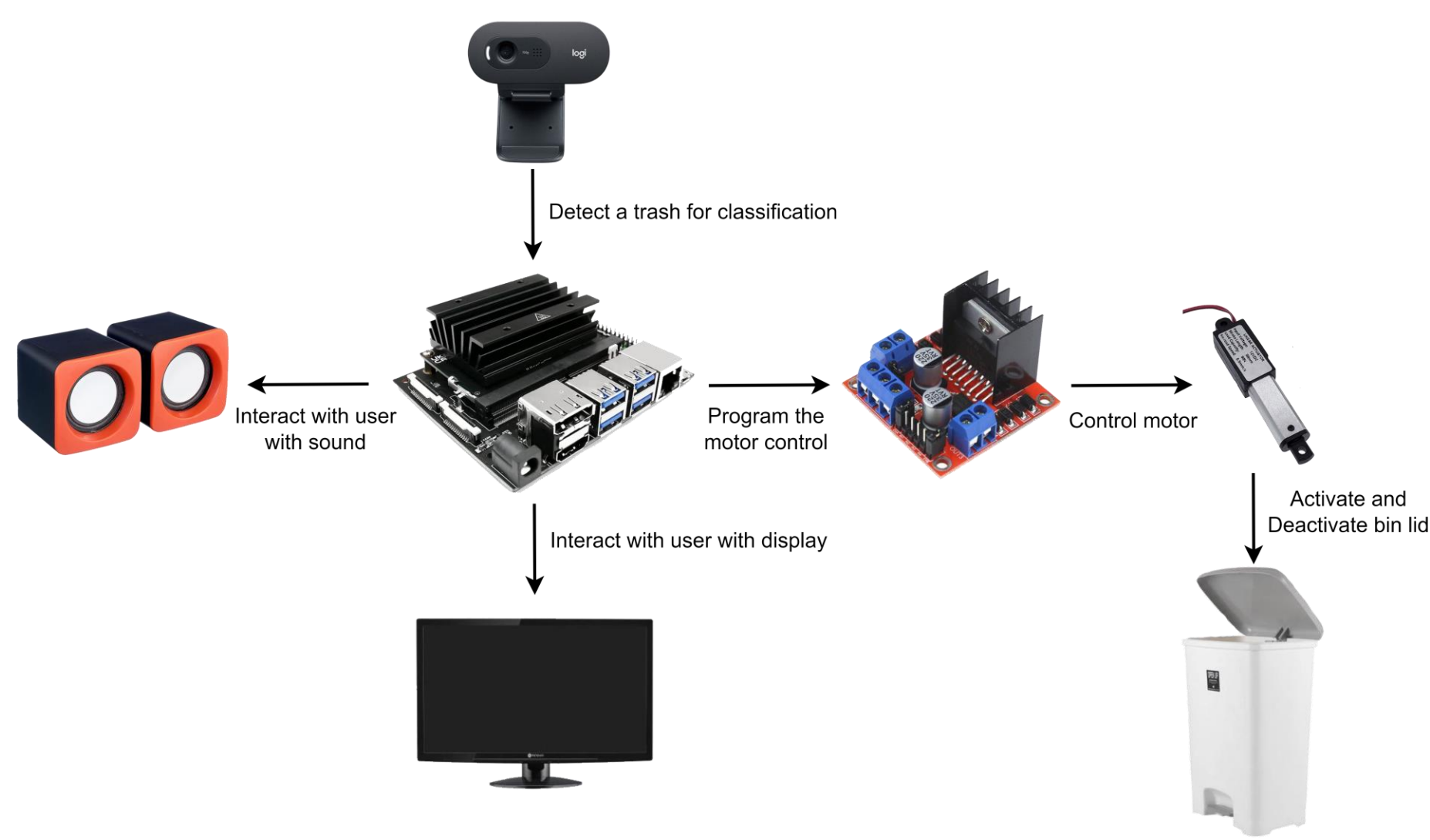
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Background & Introduction

Waste segregation is an important step in waste disposal. The different types of waste have different disposal methods. Disposing waste without managing it might have an inert effect on the efficiency of waste disposal. However, most of the residents still do not cooperate with the waste segregation campaign because of the inadequate amount of knowledge in waste segregation. An automation concept is applied as a solution to develop good practices in performing waste segregation especially among the young generations.

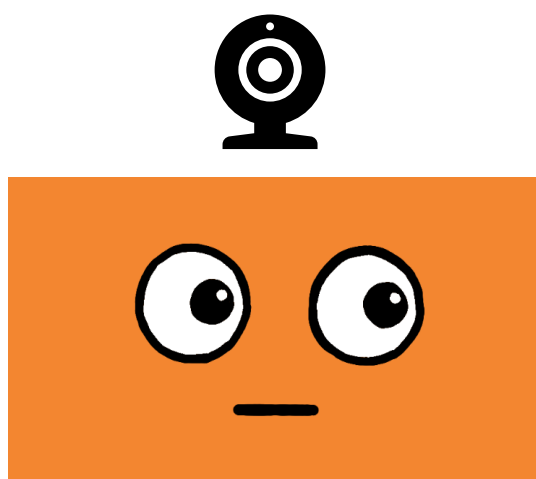
The interactive waste segregation bin can automatically segregate waste according to four waste types in Thailand which are dry waste, compostable waste, recyclable waste and hazardous waste by using image processing through the YOLOv7 for detecting the trash from user. The interactive bin can interact and guide the user to perform proper waste segregation by display and sound.

System Overview

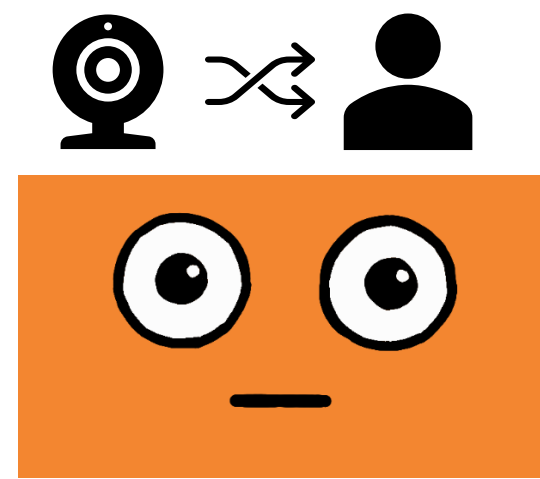


The waste segregation process starts when the camera can detect a user coming within a face detection distance. After the camera detects the trash, shown by the user. The image data of the trash will be sent to the Jetson Nano board for the waste type classification process.

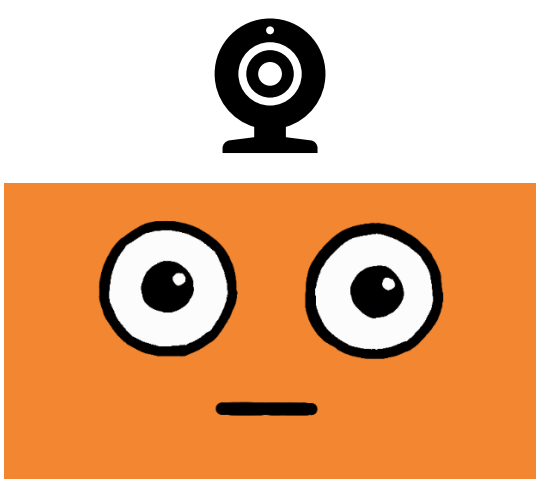
① The system waits for a human



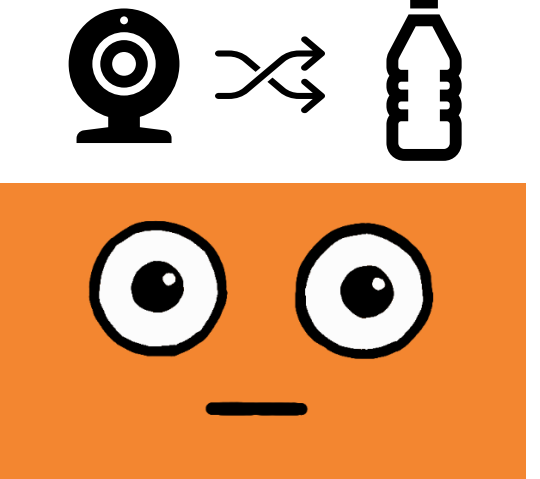
② The camera detects a human and says greeting



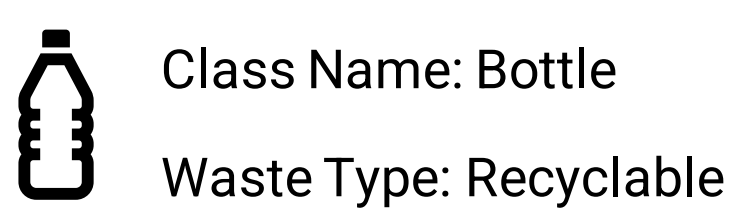
③ The system waits for a trash



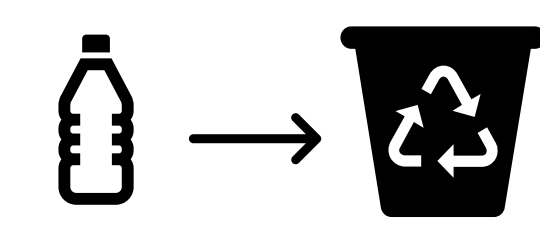
④ The system detects a trash



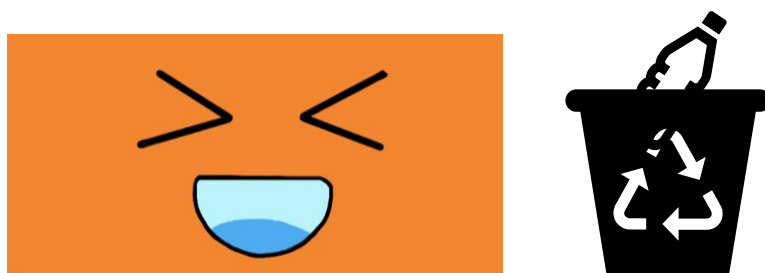
⑤ Classify trash class and type



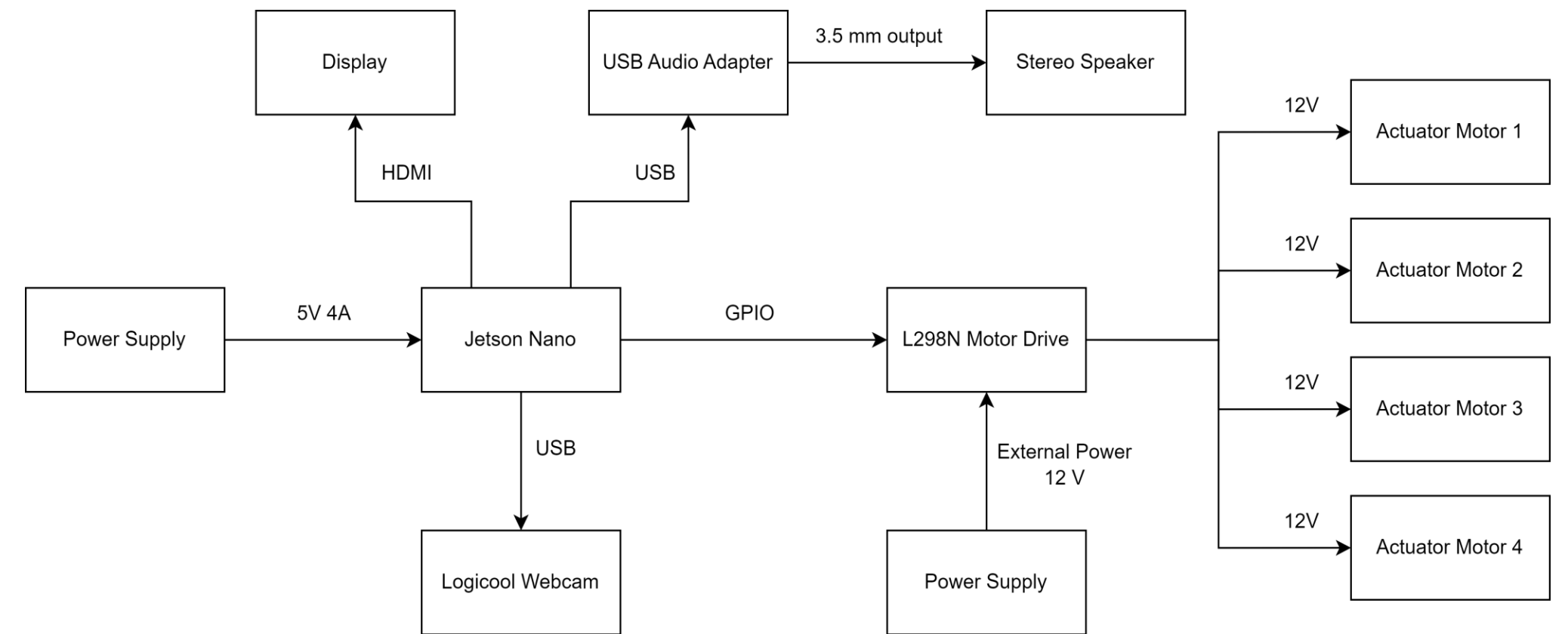
⑥ Activate bin according to its waste type



⑦ Deactivate the bin and says thank you



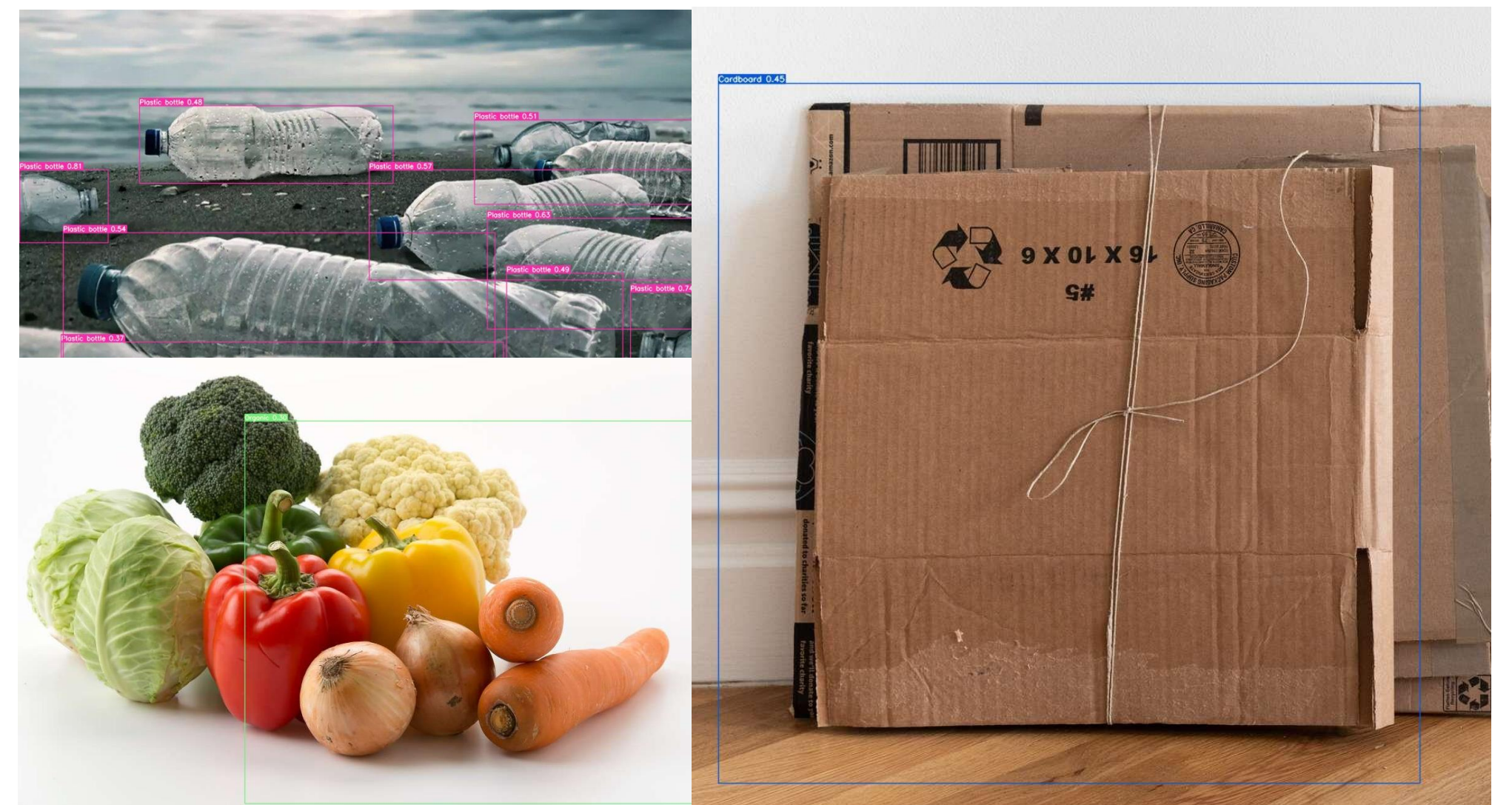
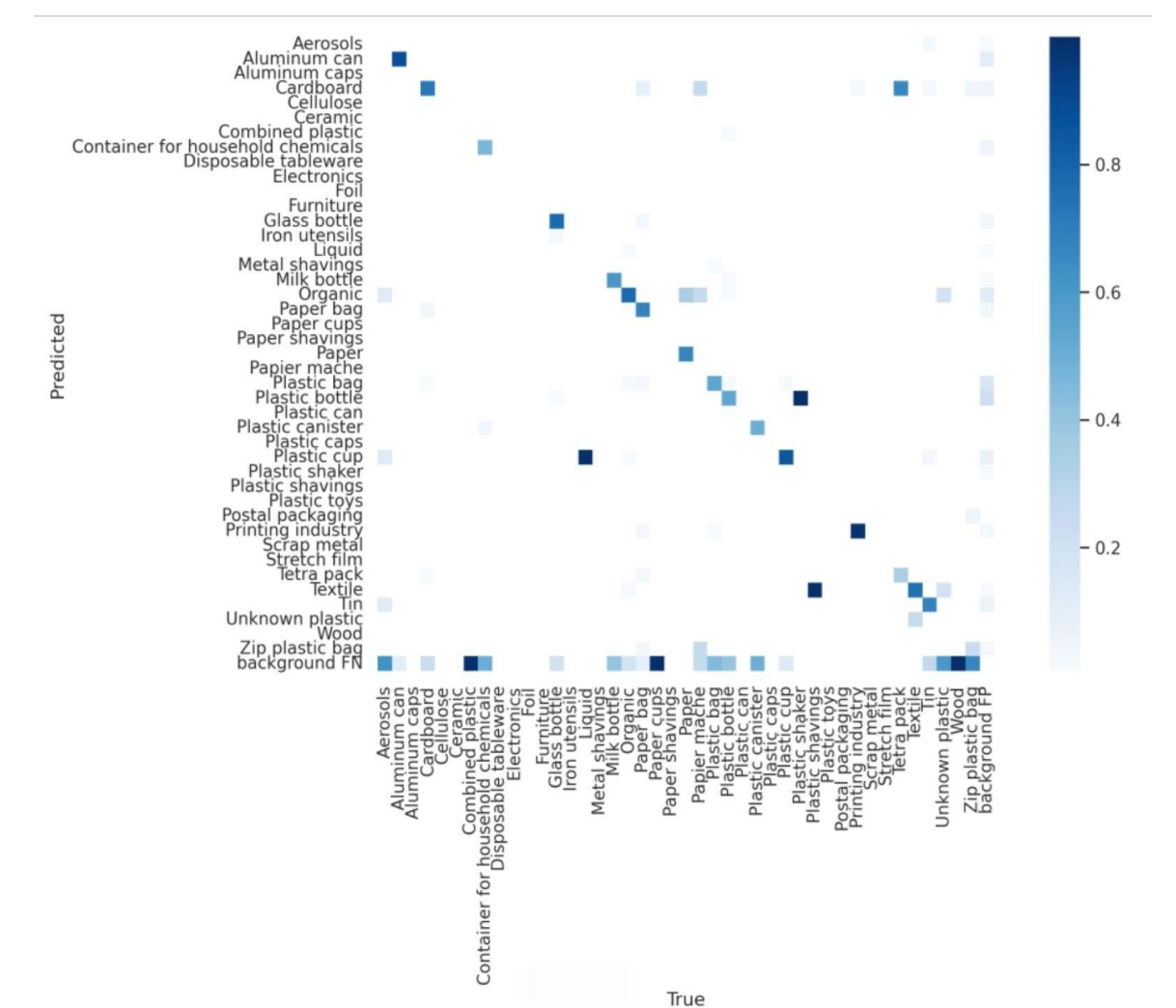
Hardware Design



The Jetson Nano is used as a main operating processor which requires a 5 volts power supply. The screen is displayed by HDMI connection. Both USB ports are used to connect camera and audio adapter which will speak out by 3.5 mm output. The L298N motor drive had operated by GPIO connection to control the motors which required an external 12 volts DC power supply for motor driving.

Result

The confusion matrix is the result of fine tuning YOLOv7 model with custom hyperparameters and custom dataset which contains of 42 classes. There are a total of 18 classes whom prediction and the true label are identical. The classes that can be detected belong to all waste types with recyclable waste having the biggest number of classes.



The inference output includes the bounding box drawn around the objects and labeled with their classes and possibilities. The waste type corresponding to the object will be provided and subsequently activate the bin.

Conclusion



The interactive waste segregation bin is designed to encourage and facilitate users in waste segregation process with the use of object detection and classification. Along with automatic bin lid mechanism and interactive entertaining functions.