Selfit

Self-Checkout Machine for Produce (Fruits)

EE131 - Edge Computing Final Project Presentation

Team - 1

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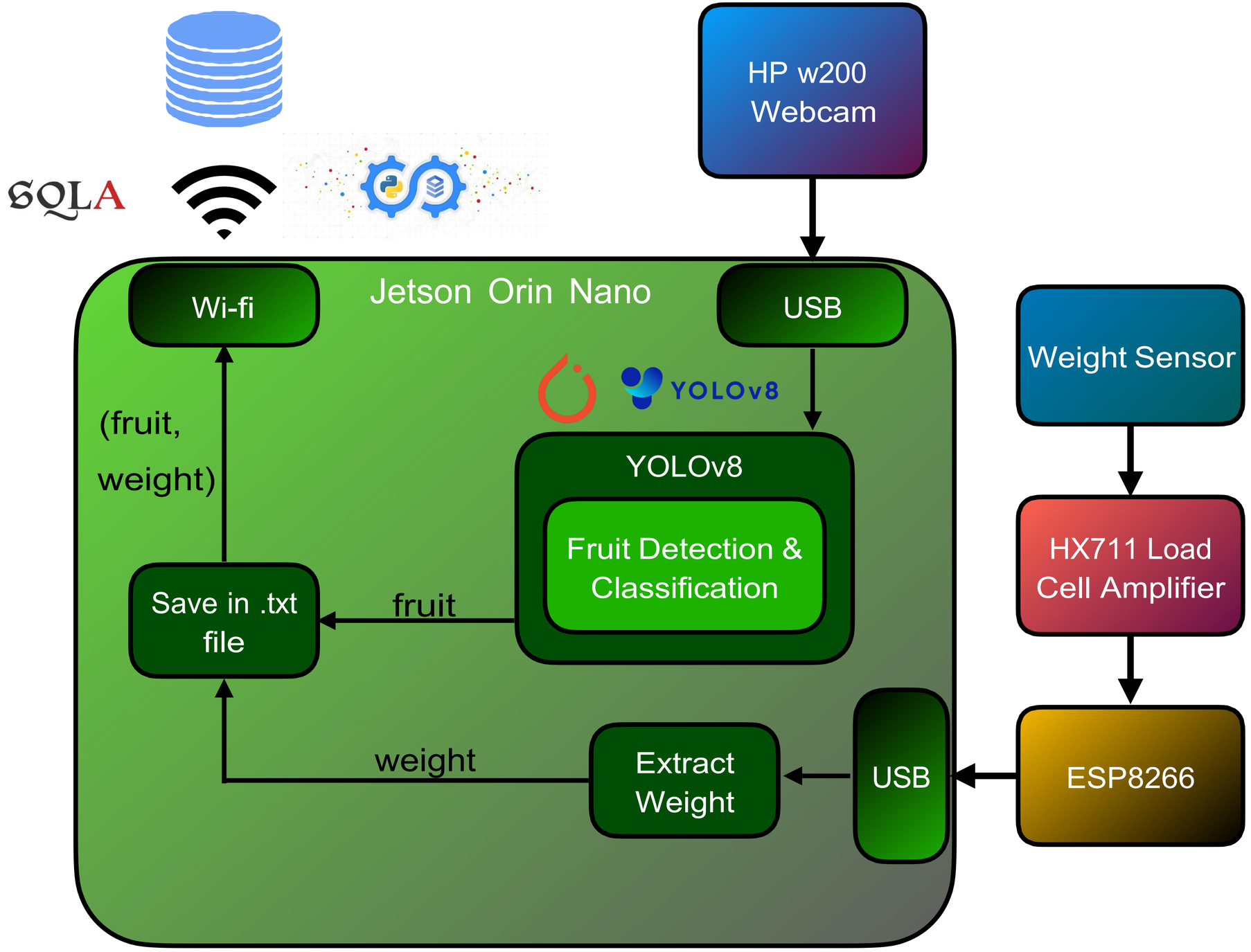
Problem Statement

- Checkout in supermarkets is often slow and prone to mistakes, for both customers and staff.
- Long queues at checkout counters lead to customer dissatisfaction and a negative shopping experience.
- Manual billing processes can result in pricing errors as the fruit variety customer inputs may be wrong.
- Additionally, fruits and vegetables, which often lack barcodes, can further complicate the checkout process, requiring manual entry and increasing the likelihood of errors.

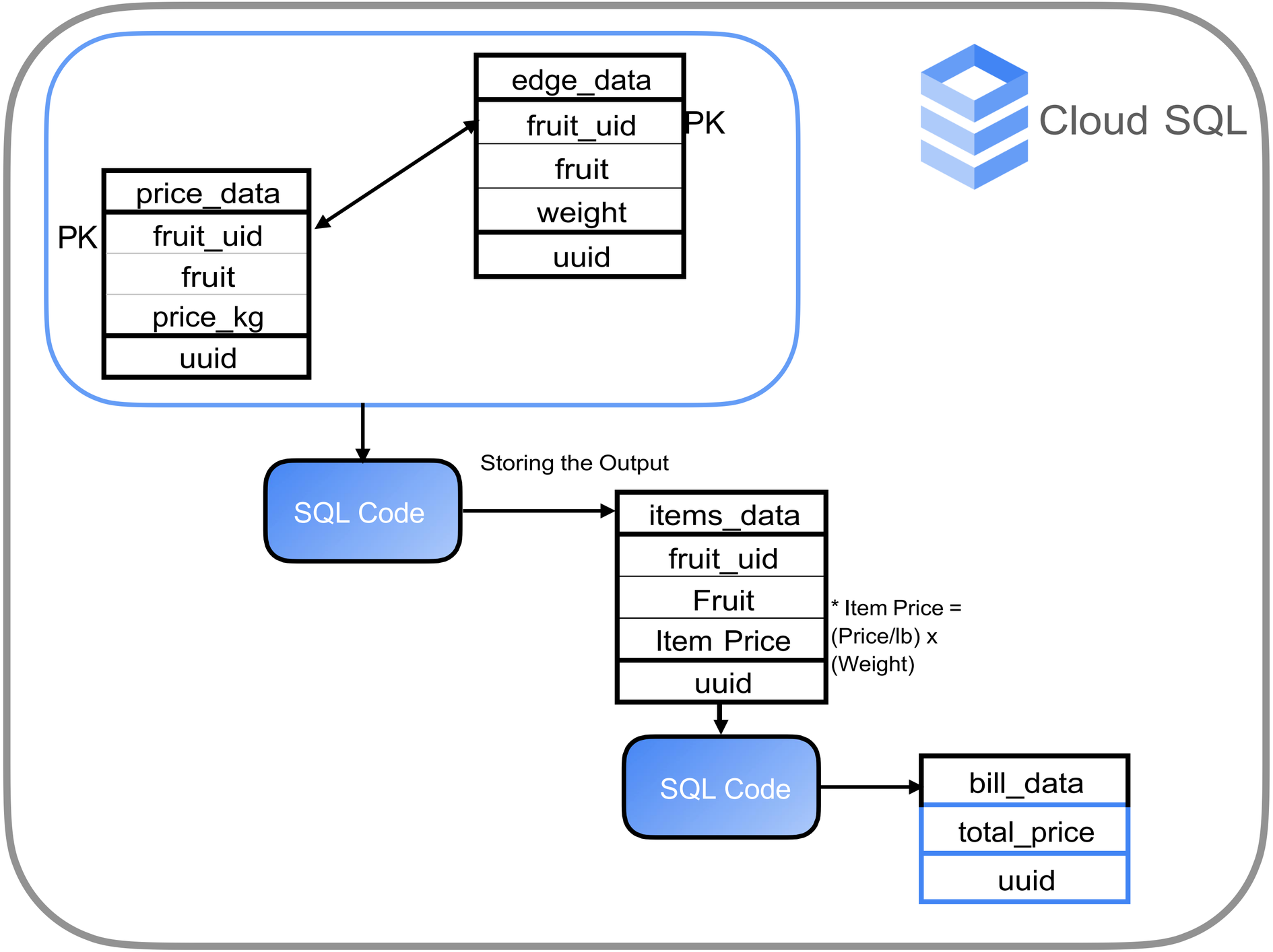
Solution

- Finer granularity in fruits classification.
- Price can be updated by shop owner in database.
- Edge-inference for reduced latency and interacts with cloud to give bill data of customer.
- The cloud server has automatic backup options and other features which make it a better option for cloud implementation.

Edge Device

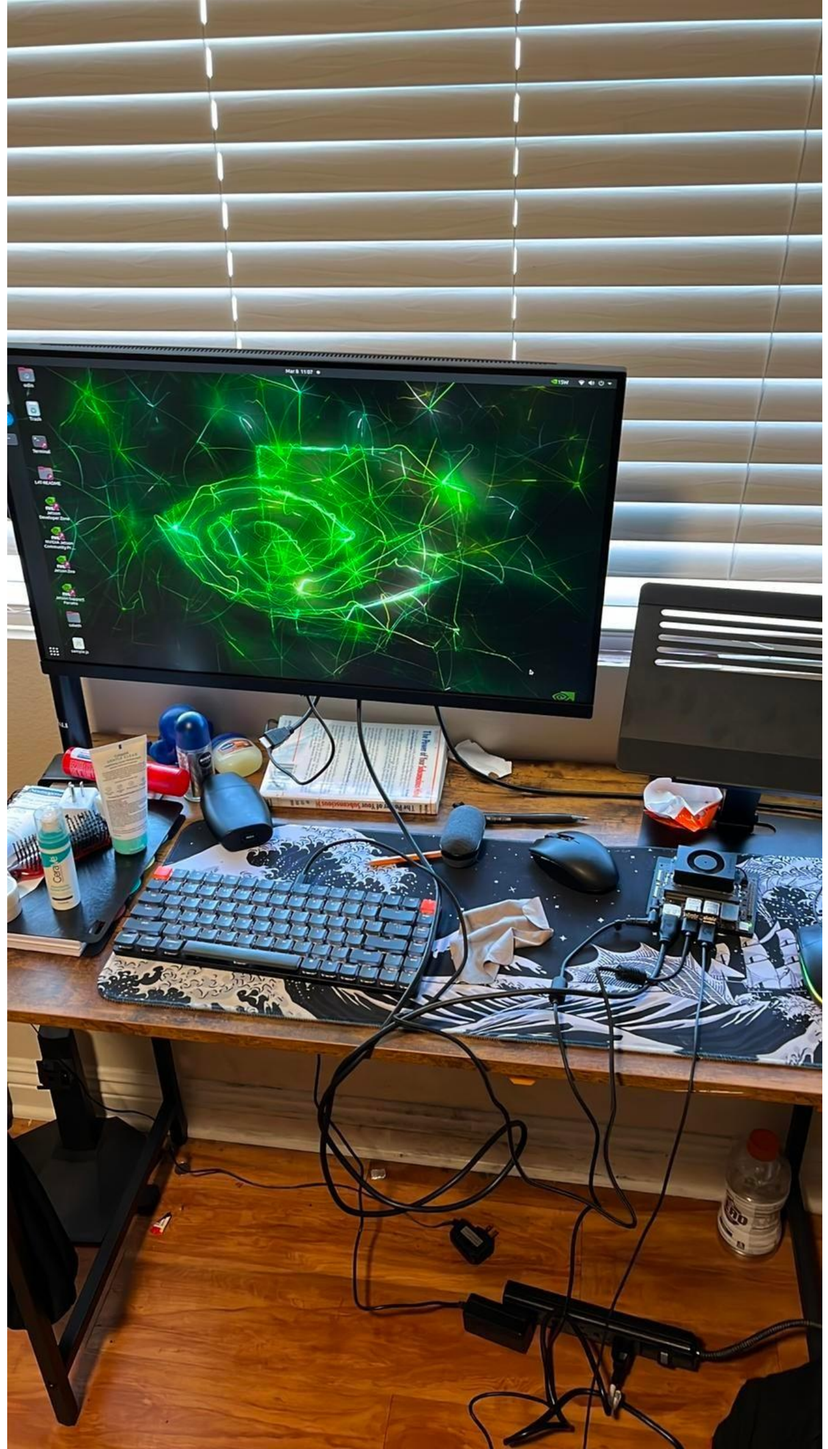

HP w200 Webcam
SQLA
Jetson Orin Nano
Wi-fi
USB
YOLOv8
YOLOv8
Fruit Detection & Classification
(fruit, weight)
Save in .txt file
fruit
weight
Extract Weight
USB
Weight Sensor
HX711 Load Cell Amplifier
ESP8266
NVIDIA
JETSON

Cloud


Cloud SQL
edge_data
fruit_uid
fruit
weight
uuid
PK
price_data
PK
fruit_uid
fruit
price_kg
uuid
SQL Code
Storing the Output
items_data
fruit_uid
Fruit
Item Price
uuid
* Item Price = (Price/lb) x (Weight)
SQL Code
bill_data
total_price
uuid

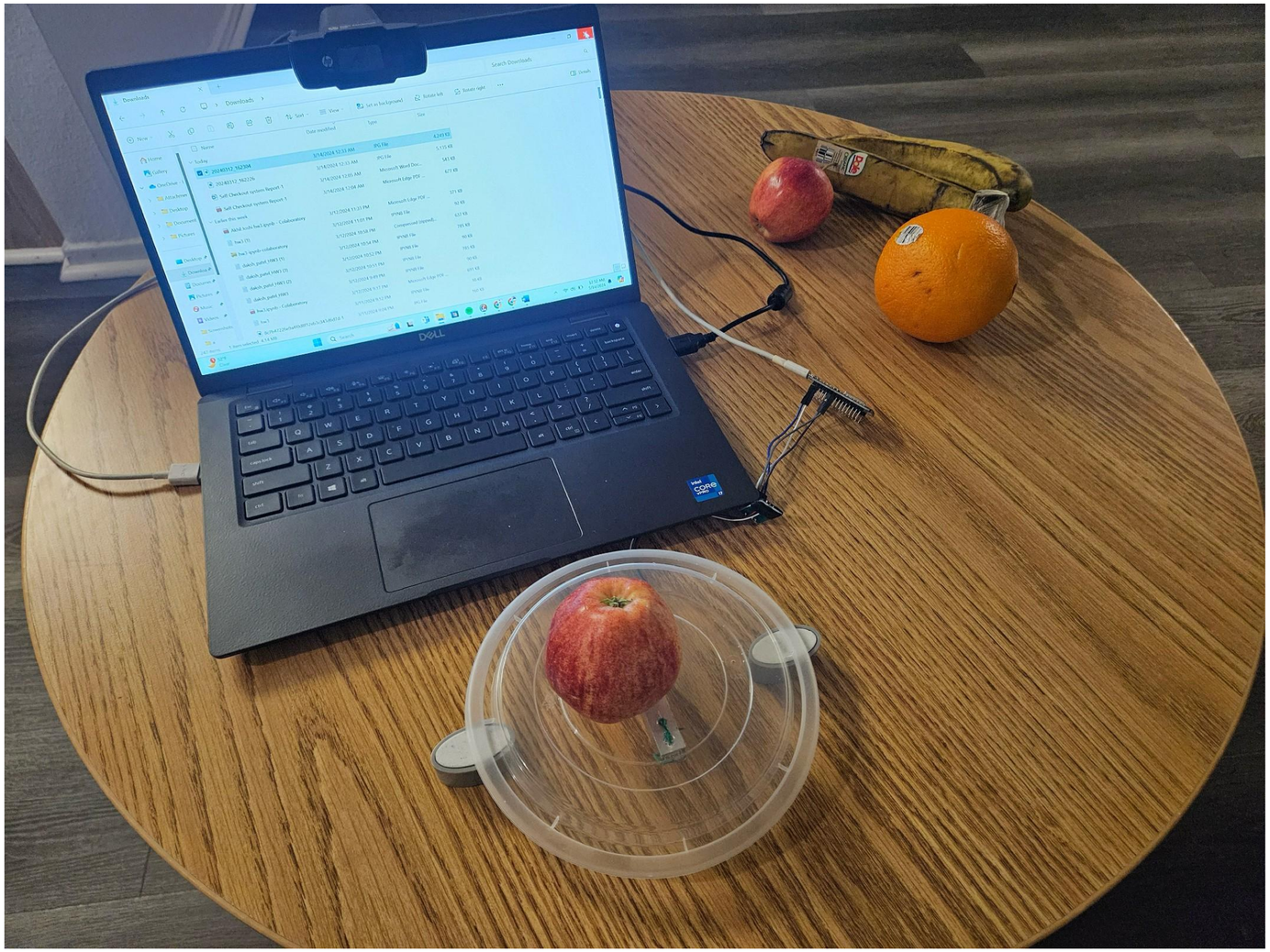
Jetson Orin Nano Issues

- First OS crashed.
- Were able to recover files once we fixed it with Disk Utility. It turned on once and then the second time it stopped turning on.
- Board seems to be an issue as we flashed a new OS but there is not response from the board.

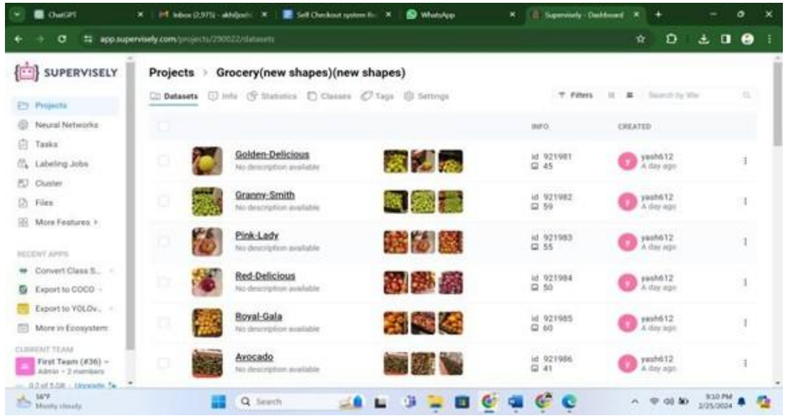


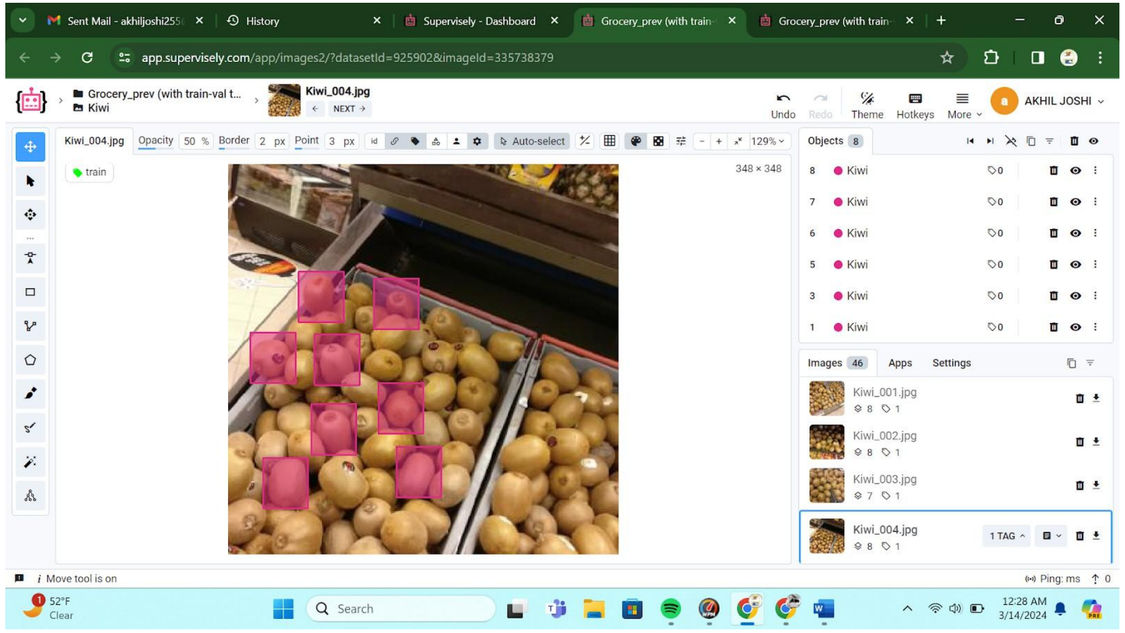
Weight Sensor Issues

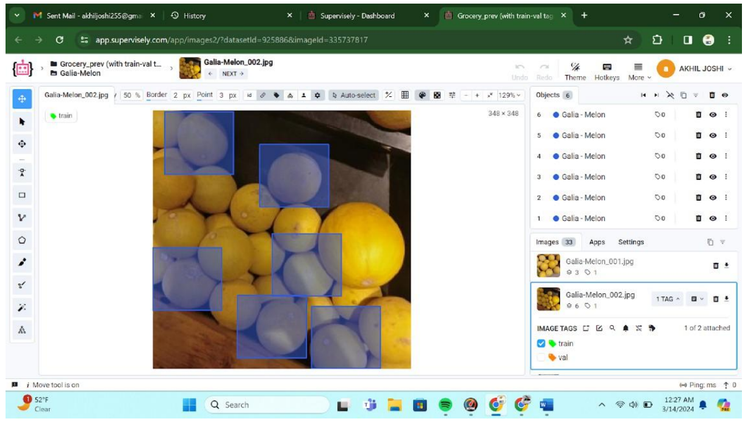
- Plate was not correct.
- ESP8266 had drivers for the HX711 Load cell.
- Values was different each time an object was placed due to improper plate.

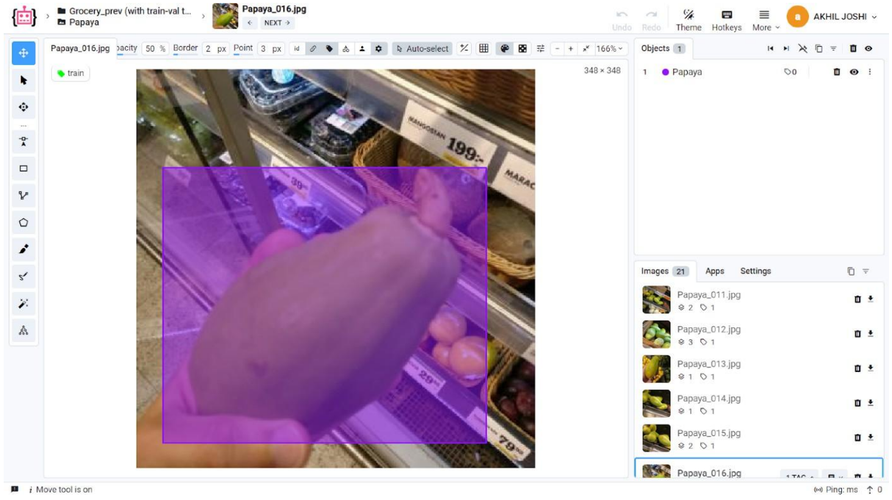


Dataset


SUPERVISELY
Projects › Grocery(new shapes)(new shapes)
Golden-Delicious
Granny-Smith
Pink-Lady
Red-Delicious
Royal-Gala
Avocado


app.supervisely.com/app/images2/?datasetId=925902&imageId=335738379
Grocery_prev (with train-val t...
Kiwi
Kiwi_004.jpg
AKHIL JOSHI
Undo
Redo
Theme
Hotkeys
More
Objects 8
8 Kiwi
7 Kiwi
6 Kiwi
5 Kiwi
3 Kiwi
1 Kiwi
Images 46
Apps
Settings
Kiwi_001.jpg
Kiwi_002.jpg
Kiwi_003.jpg
Kiwi_004.jpg
1 TAG
Move tool is on
Ping: ms
Search


app.supervisely.com/app/images2/?datasetId=925866&imageId=335737817
Grocery_prev (with train-val t...
Galia-Melon
Galia-Melon_002.jpg
AKHIL JOSHI
Galia - Melon
Images 33
Apps
Settings
Galia-Melon_001.jpg
Galia-Melon_002.jpg
1 TAG
IMAGE TAGS
train
val
Move tool is on
Search


Grocery_prev (with train-val t...
Papaya
Papaya_016.jpg
AKHIL JOSHI
Undo
Redo
Theme
Hotkeys
More
Objects 1
1 Papaya
Images 21
Apps
Settings
Papaya_011.jpg
Papaya_012.jpg
Papaya_013.jpg
Papaya_014.jpg
Papaya_015.jpg
Papaya_016.jpg
Move tool is on
Ping: ms

Training & Augmentation

- Image size 640x640.
- Epochs - 50
- Augmentations: -
  - Flip LR
  - Flip UD
  - Scale
  - Mosaic
  - Mixup
  - Translate
  - Randaugment

Activities Terminal Mar 11 13:59 15W

fruit_detector.py - Code - OSS

File Edit Selection View Go Debug Terminal Help

fruit_detector.py

```python
from ultralytics import YOLO
import cv2
import argparse
classes={0: 'Kiwi', 1: 'Lemon', 2: 'Lime', 3: 'Mango', 4: 'Cantaloupe', 5: 'Galia - Melon', 6: 'Honeydrew Melon', 7: 'Watermelon', 8: 'Nectarine', 9: 'Orange', 10: 'Papaya', 11: 'Passion Fruit', 12: 'Peach', 13: 'Anjou', 14: 'Conference', 15: 'Kaiser', 16: 'Pineapp

def detector(image):

    cap=cv2.VideoCapture(0)
    if not cap.isOpened():
        print('no video')
        exit()
    ret,frame=cap.read()

    if ret:
        print('using image')
        # Load a model
        model = YOLO('yolonew.pt',task='detect')  # pretrained YOLOv8n model

        # Run batched inference on a list of images
        results= model.predict(frame,show=True,conf=0.2)  # return a list of Results


        detected_objects=results[0].boxes.cls.to('cuda').tolist()
        confi=results[0].boxes.conf.to('cuda').tolist()
        bbox=results[0].boxes.xyxy.to('cuda').tolist()

        with open('detected_class.txt','w') as f:
            for i,bb in enumerate(bbox):
                score=confi[i]
                if score>0.05:
                    f.write(f'{classes[int(detected_objects[i])]},{score:.4f}\n')

        cv2.waitKey(0)

        cap.release()
        cv2.destroyAllWindows()


if __name__=='__main__':
    parser = argparse.ArgumentParser(description="Object detection with YOLOv8")
    parser.add_argument('image_path', type=str, help='Path to the image file')
    args = parser.parse_args()

    detector(args.image_path)
```

image0.jpg

odin@odin-desktop: ~/Documents/yolov8

```
[ WARN:0] global ../modules/videoio/src/cap_gstreamer.cpp (935) open OpenCV | GS
treamer warning: Cannot query video position: status=0, value=-1, duration=-1
using image

0: 384x640 1 Galia - Melon, 1 Watermelon, 306.7ms
Speed: 7.6ms preprocess, 306.7ms inference, 5.8ms postprocess per image at shape
 (1, 3, 384, 640)
odin@odin-desktop:~/Documents/yolov8$ python3 fruit_detector.py ava1.jpg
[ WARN:0] global ../modules/videoio/src/cap_gstreamer.cpp (935) open OpenCV | GS
treamer warning: Cannot query video position: status=0, value=-1, duration=-1
using image

0: 384x640 1 Galia - Melon, 1 Red Grapefruit, 1 Satsumas, 297.6ms
Speed: 7.0ms preprocess, 297.6ms inference, 6.0ms postprocess per image at shape
 (1, 3, 384, 640)
odin@odin-desktop:~/Documents/yolov8$ python3 fruit_detector.py ava1.jpg
[ WARN:0] global ../modules/videoio/src/cap_gstreamer.cpp (935) open OpenCV | GS
treamer warning: Cannot query video position: status=0, value=-1, duration=-1
using image

0: 384x640 1 Banana, 301.1ms
Speed: 7.0ms preprocess, 301.1ms inference, 6.5ms postprocess per image at shape
 (1, 3, 384, 640)
```

0 0 Ln 20, Col 64 Spaces: 4 UTF-8 LF Python

Activities Terminal Mar 10 19:39 15W

fruit_detector.py - Code - OSS

File Edit Selection View Go Debug Terminal Help

fruit_detector.py

```python
from ultralytics import YOLO
import cv2
import argparse
classes={0: 'Kiwi', 1: 'Lemon', 2: 'Lime', 3: 'Mango', 4: 'Cantaloupe', 5: 'Galia - Melon', 6: 'Honeydrew Melon', 7: 'Watermelon', 8: 'Nectarine', 9: 'Orange', 10: 'Papaya', 11: 'Passion Fr

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```

image0.jpg

odin@odin-desktop: ~/Documents/yolov8

```
[ WARN:0] global ../modules/videoio/src/cap_gstreamer.cpp (935) open OpenCV | GS
treamer warning: Cannot query video position: status=0, value=-1, duration=-1
using image

0: 384x640 (no detections), 294.7ms
Speed: 7.0ms preprocess, 294.7ms inference, 2.6ms postprocess per image at shape
 (1, 3, 384, 640)
odin@odin-desktop:~/Documents/yolov8$ python3 fruit_detector.py orange1.jpg
[ WARN:0] global ../modules/videoio/src/cap_gstreamer.cpp (935) open OpenCV | GS
treamer warning: Cannot query video position: status=0, value=-1, duration=-1
using image

0: 384x640 (no detections), 298.0ms
Speed: 6.8ms preprocess, 298.0ms inference, 3.0ms postprocess per image at shape
 (1, 3, 384, 640)
odin@odin-desktop:~/Documents/yolov8$ python3 fruit_detector.py orange1.jpg
[ WARN:0] global ../modules/videoio/src/cap_gstreamer.cpp (935) open OpenCV | GS
treamer warning: Cannot query video position: status=0, value=-1, duration=-1
using image

0: 384x640 1 Red Delicious, 300.2ms
Speed: 7.2ms preprocess, 300.2ms inference, 221.1ms postprocess per image at sha
pe (1, 3, 384, 640)
```

0 0

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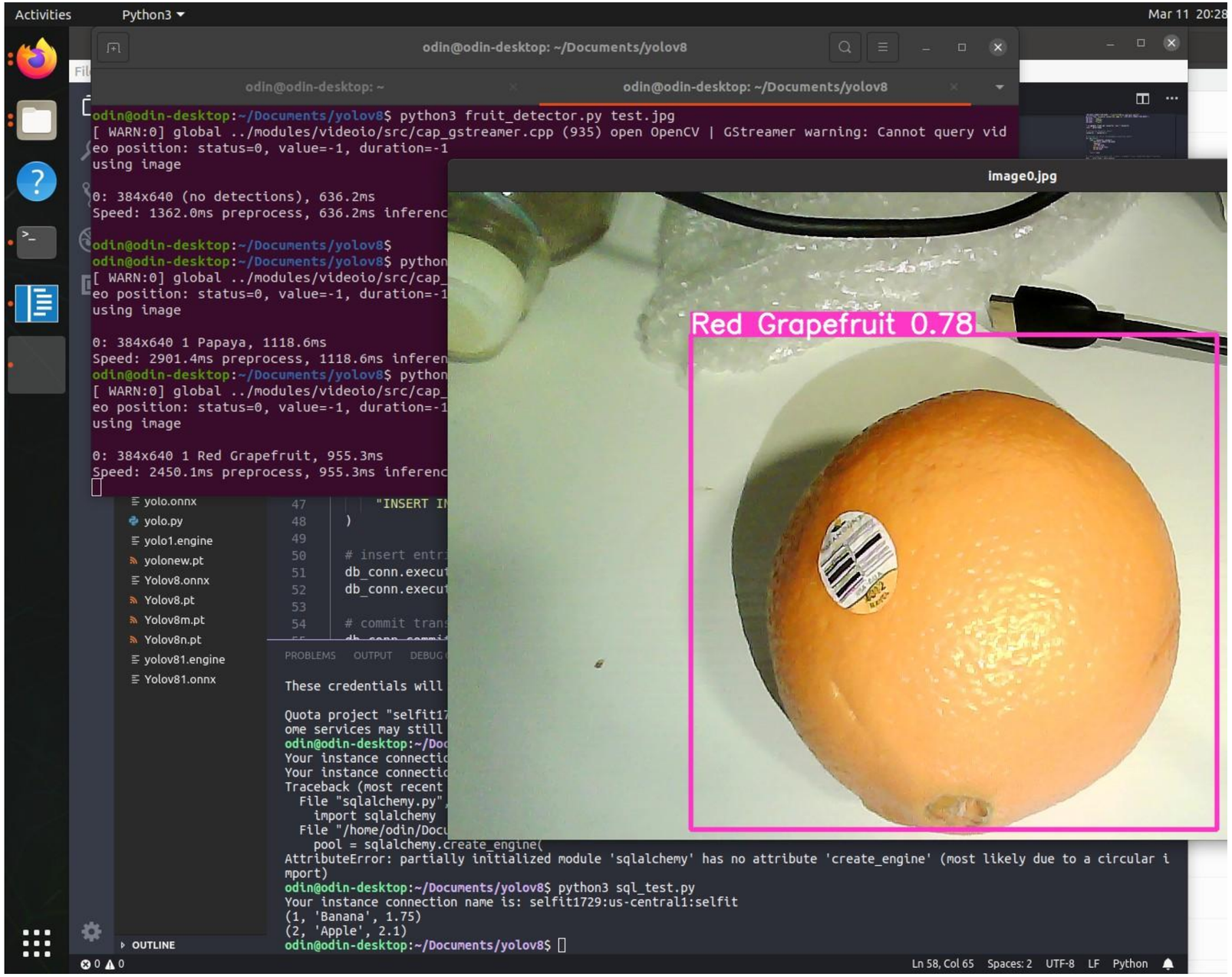
Activities
Python3
Mar 11 20:28
odin@odin-desktop: ~/Documents/yolov8
odin@odin-desktop: ~
odin@odin-desktop: ~/Documents/yolov8
odin@odin-desktop:~/Documents/yolov8$ python3 fruit_detector.py test.jpg
[WARN:0] global ../modules/videoio/src/cap_gstreamer.cpp (935) open OpenCV | GStreamer warning: Cannot query vid
eo position: status=0, value=-1, duration=-1
using image
0: 384x640 (no detections), 636.2ms
Speed: 1362.0ms preprocess, 636.2ms inferenc
odin@odin-desktop:~/Documents/yolov8$
odin@odin-desktop:~/Documents/yolov8$ python
[WARN:0] global ../modules/videoio/src/cap_
eo position: status=0, value=-1, duration=-1
using image
0: 384x640 1 Papaya, 1118.6ms
Speed: 2901.4ms preprocess, 1118.6ms inferen
odin@odin-desktop:~/Documents/yolov8$ python
[WARN:0] global ../modules/videoio/src/cap_
eo position: status=0, value=-1, duration=-1
using image
0: 384x640 1 Red Grapefruit, 955.3ms
Speed: 2450.1ms preprocess, 955.3ms inferenc
image0.jpg
Red Grapefruit 0.78
yolo.onnx
yolo.py
yolo1.engine
yolonew.pt
Yolov8.onnx
Yolov8.pt
Yolov8m.pt
Yolov8n.pt
yolov81.engine
Yolov81.onnx
"INSERT IN
)
insert entr
db_conn.execut
db_conn.execut
commit trans
PROBLEMS
OUTPUT
DEBUG
These credentials will
Quota project "selfit17
ome services may still
odin@odin-desktop:~/Doc
Your instance connectio
Your instance connectio
Traceback (most recent
File "sqlalchemy.py",
import sqlalchemy
File "/home/odin/Docu
pool = sqlalchemy.create_engine(
AttributeError: partially initialized module 'sqlalchemy' has no attribute 'create_engine' (most likely due to a circular i
mport)
odin@odin-desktop:~/Documents/yolov8$ python3 sql_test.py
Your instance connection name is: selfit1729:us-central1:selfit
(1, 'Banana', 1.75)
(2, 'Apple', 2.1)
odin@odin-desktop:~/Documents/yolov8$
OUTLINE
Ln 58, Col 65
Spaces: 2
UTF-8
LF
Python