Autonomous Checkout System

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About

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Objective

This project envision the possibility to walk in, grab whatever you like and leave with a self-checkout system. But for starters, given Pakistan society’s ethical understanding shoplifting is a serious issue. Keeping in view this there is need to develop an intelligent camera-based system that keeps track of customers and items they picked from the store.

What is to be done?

- Person Detection
- Picked & Unpicked Classification
- Product Classification
- Hand Localization using OpenPose
- Desktop Application

Done

What we have done?

- Person Detection
- Picked & Unpicked Classification
- Product Classification
- Desktop Application

Done

How?

- Used Keras binary classifier for picked & Unpicked binary classification
- Trained on Dataset collected by ourselves
- Collected a Real Product Dataset
- A CNN Sequential Model for Product Classification

- A Desktop Application
- Backend: Django & Django Rest Framework
- Frontend: HTML, CSS, JavaScript
- Database: PstgreSQL

Dataset Collection

- Collected Dataset from Namal study room, where we used book shelve as products shelve.
- Mounted camera at hieght about 10ft and angle 45° from shelve.

Real Products Dataset Collection

- Collected Dataset from Namal study room, where we used book shelve as products shelve.
- Mounted camera at hieght about 10ft and angle 45° from shelve.

Product Classification

- Bottle
- Shampoo
- Biscuit
- Oil

Dataset Training & Testing Split

Product Classifier

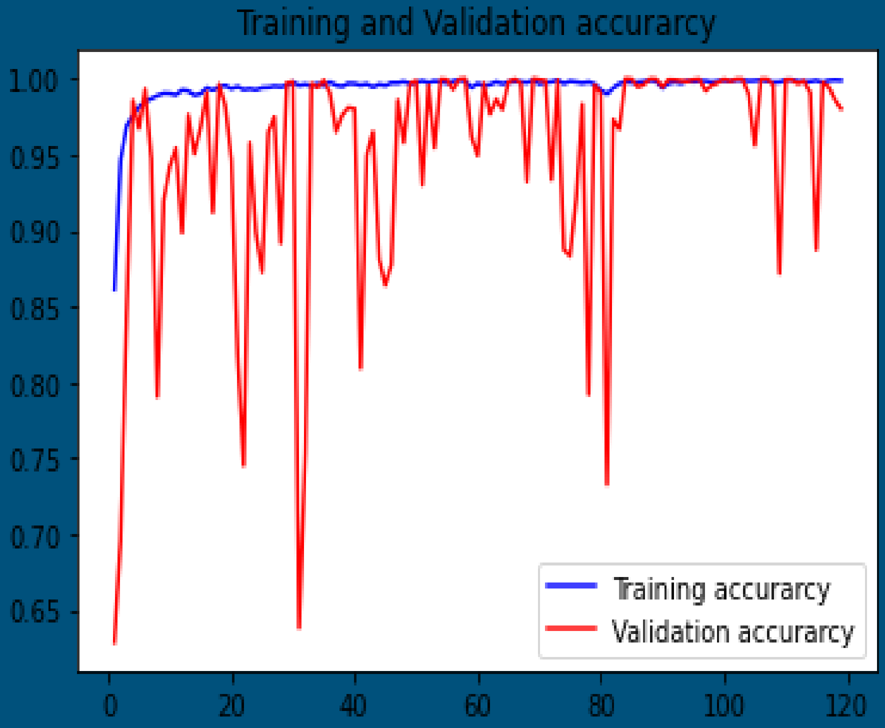
Total Images of all Products: 6800

- Training 5440: 80%
- Testing 1360: 20%

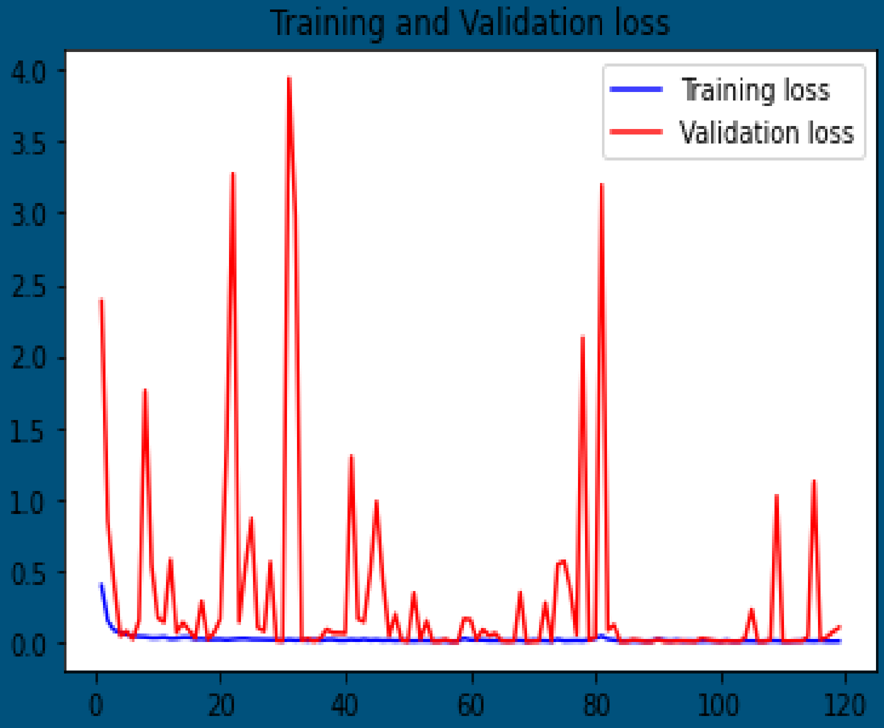
Accuracy

● Training Accuracy:	99.80%
● Testing Accuracy:	82.45%

Acurracy

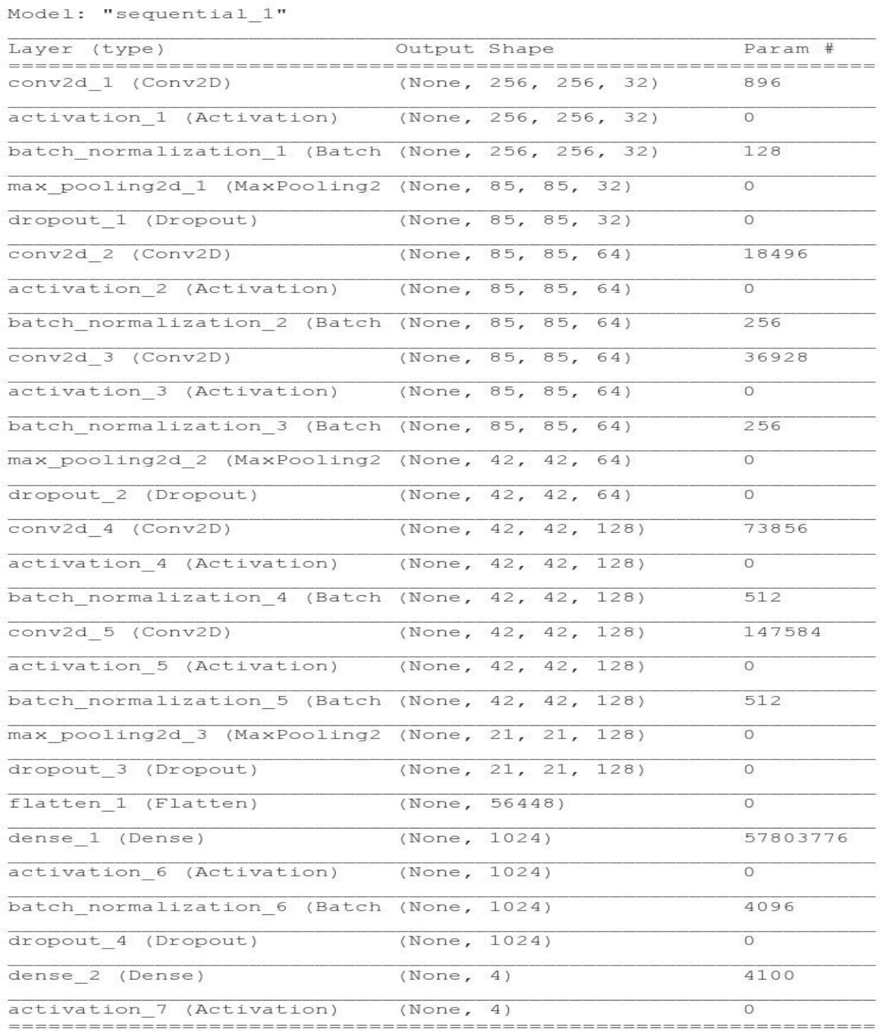


Training and Validation accurarcy



Training and Validation loss

Model Summary



```
Model: "sequential_1"
_________________________________________________________________
Layer (type)                 Output Shape              Param #   
=================================================================
conv2d_1 (Conv2D)            (None, 256, 256, 32)      896       
_________________________________________________________________
activation_1 (Activation)    (None, 256, 256, 32)      0         
_________________________________________________________________
batch_normalization_1 (Batch (None, 256, 256, 32)      128       
_________________________________________________________________
max_pooling2d_1 (MaxPooling2 (None, 85, 85, 32)        0         
_________________________________________________________________
dropout_1 (Dropout)          (None, 85, 85, 32)        0         
_________________________________________________________________
conv2d_2 (Conv2D)            (None, 85, 85, 64)        18496     
_________________________________________________________________
activation_2 (Activation)    (None, 85, 85, 64)        0         
_________________________________________________________________
batch_normalization_2 (Batch (None, 85, 85, 64)        256       
_________________________________________________________________
conv2d_3 (Conv2D)            (None, 85, 85, 64)        36928     
_________________________________________________________________
activation_3 (Activation)    (None, 85, 85, 64)        0         
_________________________________________________________________
batch_normalization_3 (Batch (None, 85, 85, 64)        256       
_________________________________________________________________
max_pooling2d_2 (MaxPooling2 (None, 42, 42, 64)        0         
_________________________________________________________________
dropout_2 (Dropout)          (None, 42, 42, 64)        0         
_________________________________________________________________
conv2d_4 (Conv2D)            (None, 42, 42, 128)       73856     
_________________________________________________________________
activation_4 (Activation)    (None, 42, 42, 128)       0         
_________________________________________________________________
batch_normalization_4 (Batch (None, 42, 42, 128)       512       
_________________________________________________________________
conv2d_5 (Conv2D)            (None, 42, 42, 128)       147584    
_________________________________________________________________
activation_5 (Activation)    (None, 42, 42, 128)       0         
_________________________________________________________________
batch_normalization_5 (Batch (None, 42, 42, 128)       512       
_________________________________________________________________
max_pooling2d_3 (MaxPooling2 (None, 21, 21, 128)       0         
_________________________________________________________________
dropout_3 (Dropout)          (None, 21, 21, 128)       0         
_________________________________________________________________
flatten_1 (Flatten)          (None, 56448)             0         
_________________________________________________________________
dense_1 (Dense)              (None, 1024)              57803776  
_________________________________________________________________
activation_6 (Activation)    (None, 1024)              0         
_________________________________________________________________
batch_normalization_6 (Batch (None, 1024)              4096      
_________________________________________________________________
dropout_4 (Dropout)          (None, 1024)              0         
_________________________________________________________________
dense_2 (Dense)              (None, 4)                 4100      
_________________________________________________________________
activation_7 (Activation)    (None, 4)                 0         
=================================================================
```

Hand Localization using OpenPose

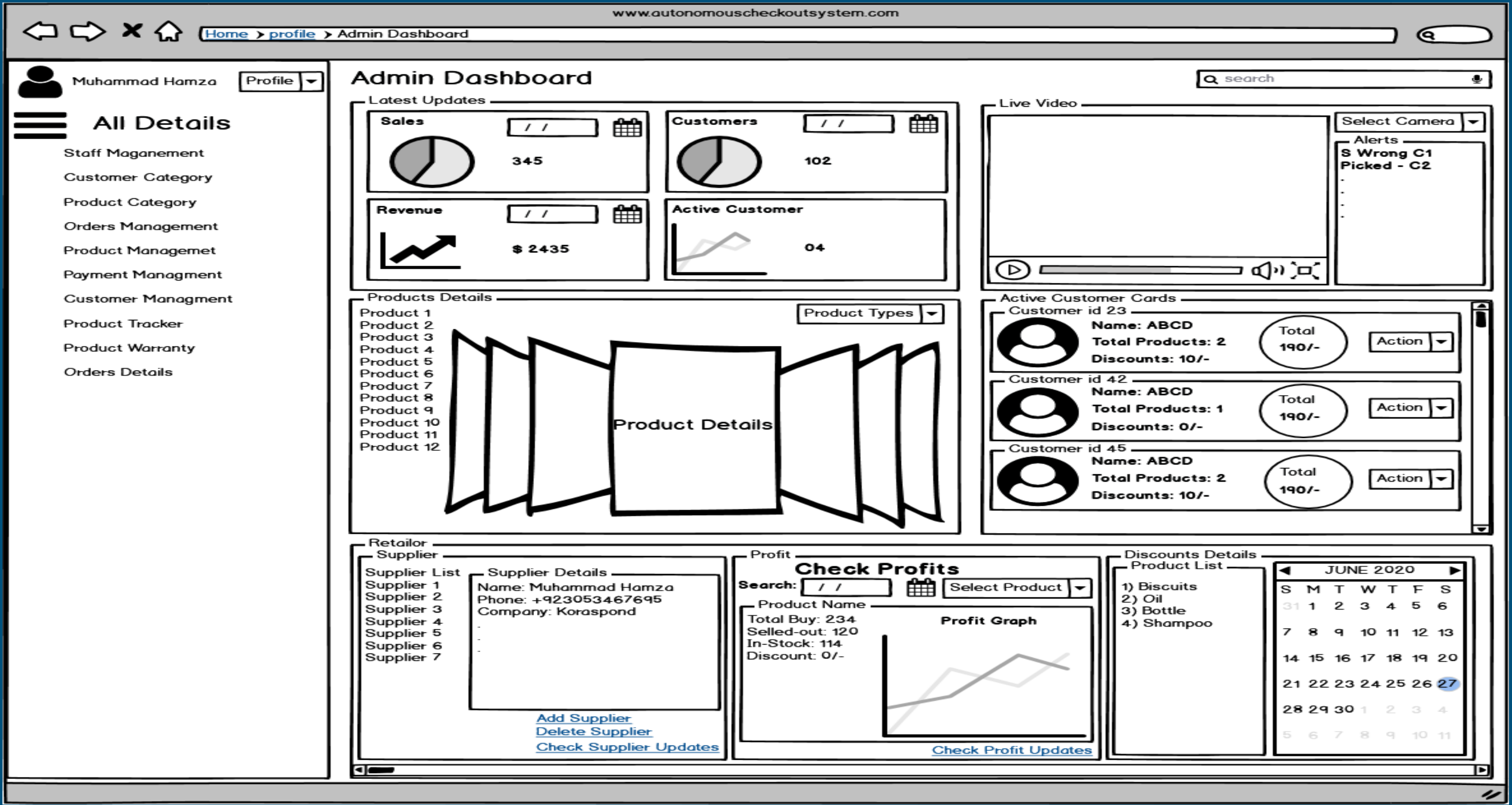
- Build on Run Time Colab
- Testing on our dataset

Desktop Application

- Front-end Design
- Database Design
- Back-end
- Rest-full API’s

Front-End (ACS-Desktop Application)

- Wireframe Design



www.autonomouscheckoutsystem.com

Home > profile > Admin Dashboard

Muhammad Hamza Profile

All Details

Staff Maganement

Customer Category

Product Category

Orders Management

Product Managemet

Payment Managment

Customer Managment

Product Tracker

Product Warranty

Orders Details

Admin Dashboard

search

Latest Updates

Sales / / 345

Customers / / 102

Revenue / / $ 2435

Active Customer 04

Live Video

Select Camera

Alerts

S Wrong C1

Picked - C2

Products Details

Product Types

Product 1
Product 2
Product 3
Product 4
Product 5
Product 6
Product 7
Product 8
Product 9
Product 10
Product 11
Product 12

Product Details

Active Customer Cards

Customer id 23
Name: ABCD
Total Products: 2
Discounts: 10/-
Total 190/-
Action

Customer id 42
Name: ABCD
Total Products: 1
Discounts: 0/-
Total 190/-
Action

Customer id 45
Name: ABCD
Total Products: 2
Discounts: 10/-
Total 190/-
Action

Retailor

Supplier

Supplier List
Supplier 1
Supplier 2
Supplier 3
Supplier 4
Supplier 5
Supplier 6
Supplier 7

Supplier Details
Name: Muhammad Hamza
Phone: +923053467695
Company: Koraspond

Add Supplier

Delete Supplier

Check Supplier Updates

Profit

Check Profits

Search: / / Select Product

Product Name
Total Buy: 234
Selled-out: 120
In-Stock: 114
Discount: 0/-

Profit Graph

Check Profit Updates

Discounts Details

Product List
1) Biscuits
2) Oil
3) Bottle
4) Shampoo

JUNE 2020

S	M	T	W	T	F	S
31	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	1	2	3	4
5	6	7	8	9	10	11

Front-End Implementation

- Dashboard Progress Cards
- Live Video
- Active Customers
- Product List
- Profit Card
- Supplier Card

Front-End Demo

Demo

Technologies

- HTML
- CSS
- JavaScript (React)
- jQuery (Dashboard Graphs)

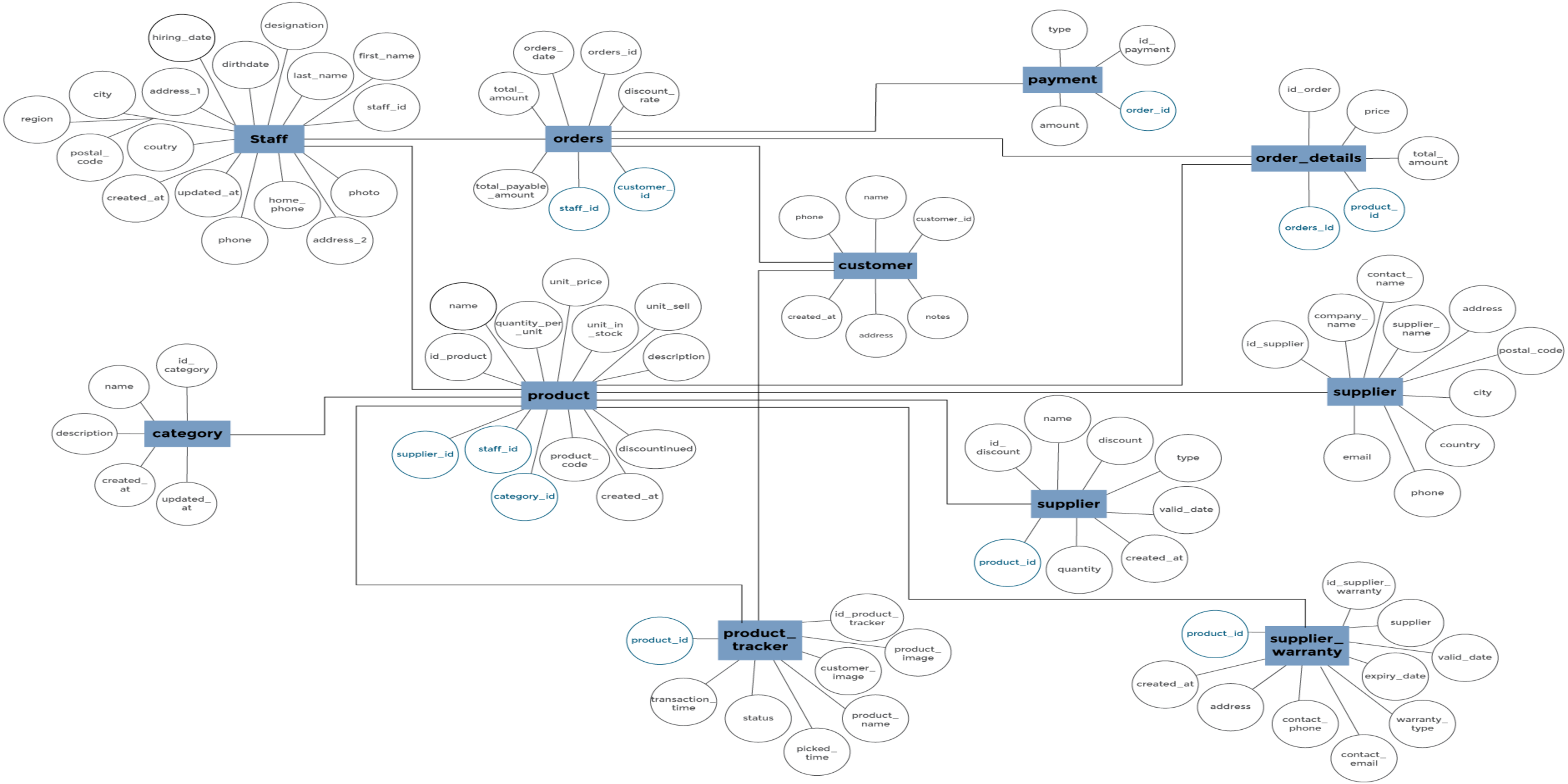
Back-End Demo

Demo

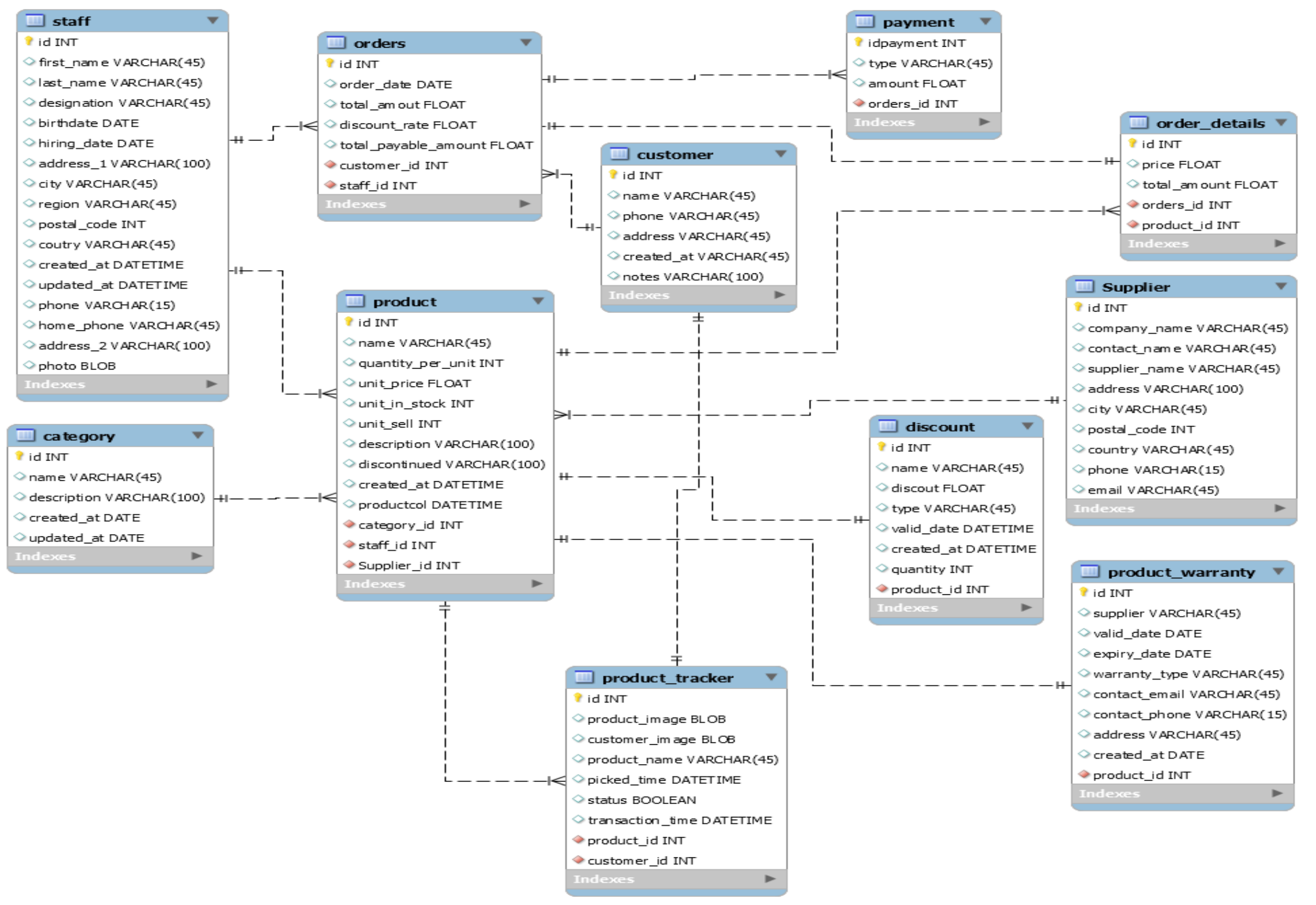
Technologies

- Django
- Django Rest Framework
- PostgreSQL (Database)
- PgAdmin 4 backend Server

ER-Diagram


Staff
hiring_date
designation
dirthdate
first_name
last_name
address_1
city
staff_id
region
coutry
postal_
code
created_at
updated_at
home_
phone
photo
phone
address_2
orders
orders_
date
orders_id
total_
amount
discount_
rate
total_payable
_amount
staff_id
customer_
id
payment
type
id_
payment
order_id
amount
order_details
id_order
price
total_
amount
product_
id
orders_id
customer
phone
name
customer_id
created_at
address
notes
product
unit_price
name
quantity_per
_unit
unit_sell
unit_in
_stock
id_product
description
supplier_id
staff_id
product_
code
discountinued
category_id
created_at
category
id_
category
name
description
created_
at
updated_
at
supplier
contact_
name
company_
name
supplier_
name
address
id_supplier
postal_code
city
email
country
phone
supplier
name
id_
discount
discount
type
valid_date
product_id
quantity
created_at
product_
tracker
id_product_
tracker
product_id
product_
image
customer_
image
transaction_
time
status
product_
name
picked_
time
supplier_
warranty
id_supplier_
warranty
product_id
supplier
valid_date
expiry_date
created_at
address
contact_
phone
warranty_
type
contact_
email

EER-Diagram



staff
id INT
first_name VARCHAR(45)
last_name VARCHAR(45)
designation VARCHAR(45)
birthdate DATE
hiring_date DATE
address_1 VARCHAR(100)
city VARCHAR(45)
region VARCHAR(45)
postal_code INT
coutry VARCHAR(45)
created_at DATETIME
updated_at DATETIME
phone VARCHAR(15)
home_phone VARCHAR(45)
address_2 VARCHAR(100)
photo BLOB
Indexes

orders
id INT
order_date DATE
total_amout FLOAT
discount_rate FLOAT
total_payable_amount FLOAT
customer_id INT
staff_id INT
Indexes

payment
idpayment INT
type VARCHAR(45)
amount FLOAT
orders_id INT
Indexes

order_details
id INT
price FLOAT
total_amount FLOAT
orders_id INT
product_id INT
Indexes

customer
id INT
name VARCHAR(45)
phone VARCHAR(45)
address VARCHAR(45)
created_at VARCHAR(45)
notes VARCHAR(100)
Indexes

product
id INT
name VARCHAR(45)
quantity_per_unit INT
unit_price FLOAT
unit_in_stock INT
unit_sell INT
description VARCHAR(100)
discontinued VARCHAR(100)
created_at DATETIME
productcol DATETIME
category_id INT
staff_id INT
Supplier_id INT
Indexes

Supplier
id INT
company_name VARCHAR(45)
contact_name VARCHAR(45)
supplier_name VARCHAR(45)
address VARCHAR(100)
city VARCHAR(45)
postal_code INT
country VARCHAR(45)
phone VARCHAR(15)
email VARCHAR(45)
Indexes

category
id INT
name VARCHAR(45)
description VARCHAR(100)
created_at DATE
updated_at DATE
Indexes

discount
id INT
name VARCHAR(45)
discout FLOAT
type VARCHAR(45)
valid_date DATETIME
created_at DATETIME
quantity INT
product_id INT
Indexes

product_warranty
id INT
supplier VARCHAR(45)
valid_date DATE
expiry_date DATE
warranty_type VARCHAR(45)
contact_email VARCHAR(45)
contact_phone VARCHAR(15)
address VARCHAR(45)
created_at DATE
product_id INT
Indexes

product_tracker
id INT
product_image BLOB
customer_image BLOB
product_name VARCHAR(45)
picked_time DATETIME
status BOOLEAN
transaction_time DATETIME
product_id INT
customer_id INT
Indexes

Tool & Technologies

- PyCharm, Jupyter, Spyder
- Anaconda
- Tensorflow, keras
- OpenCV
- Numpy, pandas, matplotlib, scikit-learn, os, pillow etc
- Streamlit (web-based framework Mid)
- Annotation tools (VoTT, Label Img)
- Django & Django Rest Framework
- Trello (Task Reminder and Assignment)

Any Question?

References

- https://opencv.org/
- https://keras.io/
- https://blog.keras.io/building-powerful-image-classification-models-using-very-little-data.html
- https://machinelearningmastery.com/
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- www.google.com
- www.Django.org