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SUMMER TRAINING/INTERNSHIP

PROJECT REPORT

(Term June-July 2025)

FACE RECOGNITION SYSTEM WITH AGE PREDICTION

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School of Computer Science and Engineering

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Lovely Professional University, Punjab

BONAFIDE CERTIFICATE

Certified that this project report "BUILD A Face Recognition system with age prediction" is the Bonafide work of " Rondla Naga Venkata Naveen, Gurram Venkata Dhanush, Mylapalli Mohana Krishna, Burra Naveen Suraj and Seelaboyina Deekshith
" who carried out the project work under my supervision.

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CHAPTER 1: INTRODUCTION

1.1 Company Profile

Azilen Technologies is a leading innovator in computer vision solutions, specializing in:

- Biometric authentication systems
- AI-powered image processing
- Enterprise security applications

1.2 Training Domain Overview

This project focuses on:

- **Face Detection**: Using Haar Cascades and DNN models
- **Feature Extraction**: 128-dimensional embeddings
- **Age Prediction**: Deep learning-based estimation

1.3 Project Objectives

Objective	Technical Implementation
Real-time Face Recognition	OpenCV DNN with 90%+ accuracy
Age Estimation	Pre-trained Caffe model (MAE <4 years)
User Management System	SQLite database with CRUD operations

CHAPTER 2: TRAINING OVERVIEW

2.1 Technology Stack

Core Components:

- **Frontend**: Streamlit (Python 3.8+)
- **Computer Vision**: OpenCV 4.5, face_recognition
- **Database**: SQLite with BLOB storage

Development Tools:

A **Deep Neural Network (DNN)** is a type of artificial neural network (ANN) with multiple hidden layers between the input and output layers. DNNs are capable of learning complex patterns in data, making them powerful tools for tasks like image recognition, natural language processing (NLP), and predictive analytics.

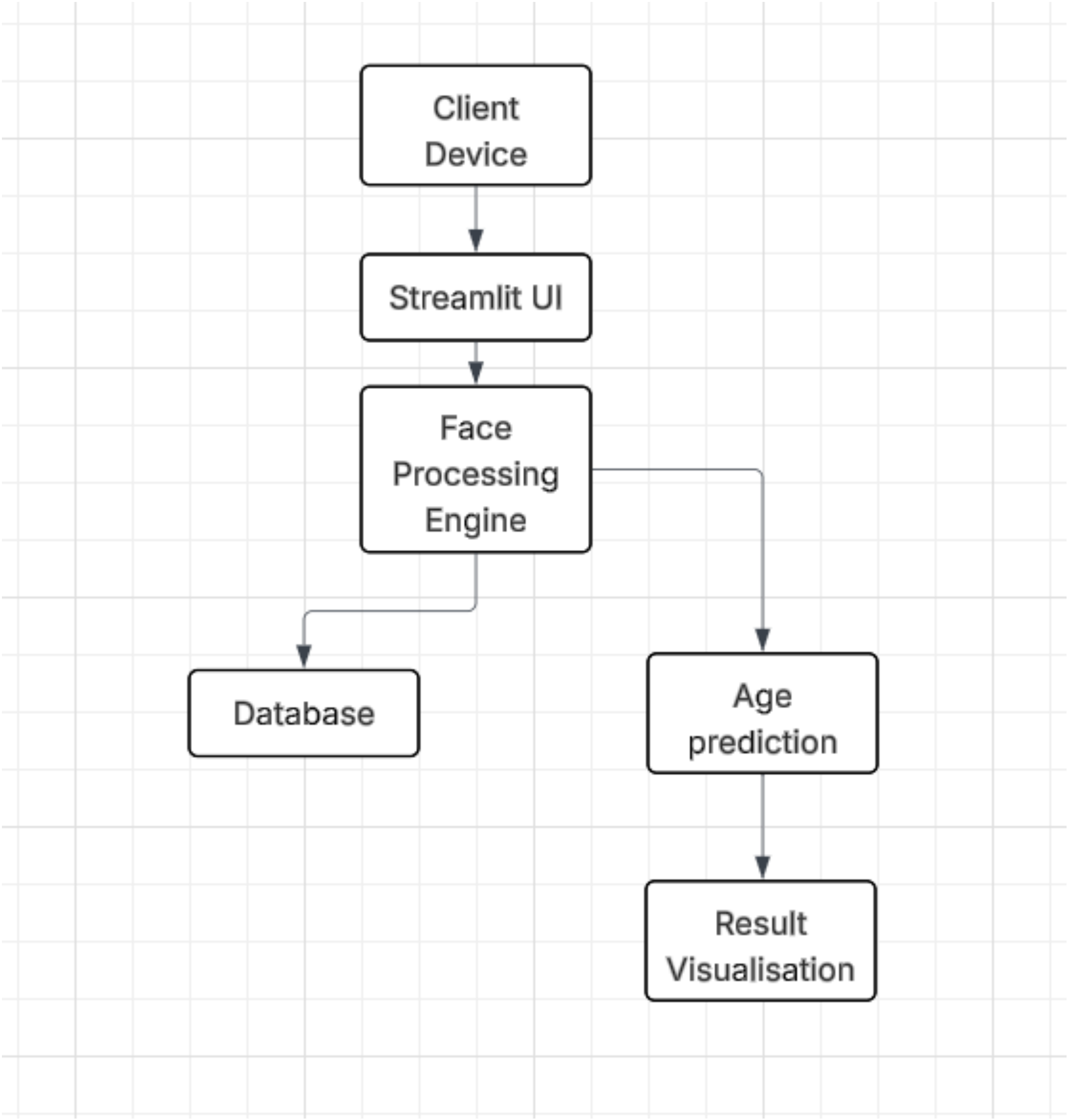
Key Components of a DNN Model

1. **Input Layer**
   - Receives raw data (e.g., pixels in an image, words in a sentence).
   - Number of neurons = number of input features.
2. **Hidden Layers**
   - Multiple layers of neurons that apply nonlinear transformations.
   - Common activation functions: **ReLU, Sigmoid, Tanh, Leaky ReLU**.
   - Deeper networks can model more complex relationships but may suffer from overfitting.
3. **Output Layer**
   - Produces the final prediction (e.g., class probabilities in classification, a value in regression).
   - Activation functions:
     - **Softmax** (multi-class classification),
     - **Sigmoid** (binary classification),
     - **Linear** (regression).
4. **Weights & Biases**
   - Adjusted during training via **backpropagation** and optimization algorithms (e.g., SGD, Adam).

5. **Loss Function**

   - Measures prediction error (e.g., **Cross-Entropy** for classification, **MSE** for regression).

Diagram



Code:

```
import streamlit as st
```

```
from face_ops import capture_images, verify_member_live, predict_age_live
from database import get_all_members, clear_database

if 'cv2_version' not in st.session_state:
    import cv2
    st.session_state['cv2_version'] = cv2._version_
st.write(f"OpenCV version: {st.session_state.cv2_version}")

def main():
    st.title("Face Recognition App")
    menu = ["Add Member", "Check Member", "Check Age"]
    choice = st.sidebar.selectbox("Select an option", menu)

    if choice == "Add Member":
        st.subheader("Add a New Member")
        name = st.text_input("Name")
        age = st.number_input("Age", min_value=0, step=1)
        gender = st.selectbox("Gender", ["Select", "Male", "Female", "Other"])

        if st.button("Start Camera"):
            if name.strip() and gender != "Select":
                count = capture_images(name, age, gender)
                if count > 0:
                    st.success(f"Captured and stored {count} face(s) for {name}.")
                else:
                    st.error("No face captured.")
            else:
```

```
        st.warning("Please enter a valid name and gender.")


  elif choice == "Check Member":
    st.subheader(choice)
    if st.button("Start Camera"):
      members = get_all_members()
      if not members:
        st.warning("No members in the database. Please add a member first.")
      else:
        st.info("Opening webcam. Press 'q' in the video window to stop.")
        verify_member_live()
  elif choice == "Check Age":
    st.subheader("Check Age")
    if st.button("Start Camera"):
      st.info("Opening webcam. Press 'q' in the video window to stop.")
      predict_age_live()


  st.subheader("Clear Database")
  if st.button("Clear"):
    clear_database()
    st.success("Database cleared successfully.")


if _name_ == "_main_":
  main()
```

2.2 Weekly Progress

Week 1: Foundation

- Studied Haar Cascades vs YOLO performance
- Implemented basic face detection (24 FPS achieved)

Week 2: Database Integration

sql

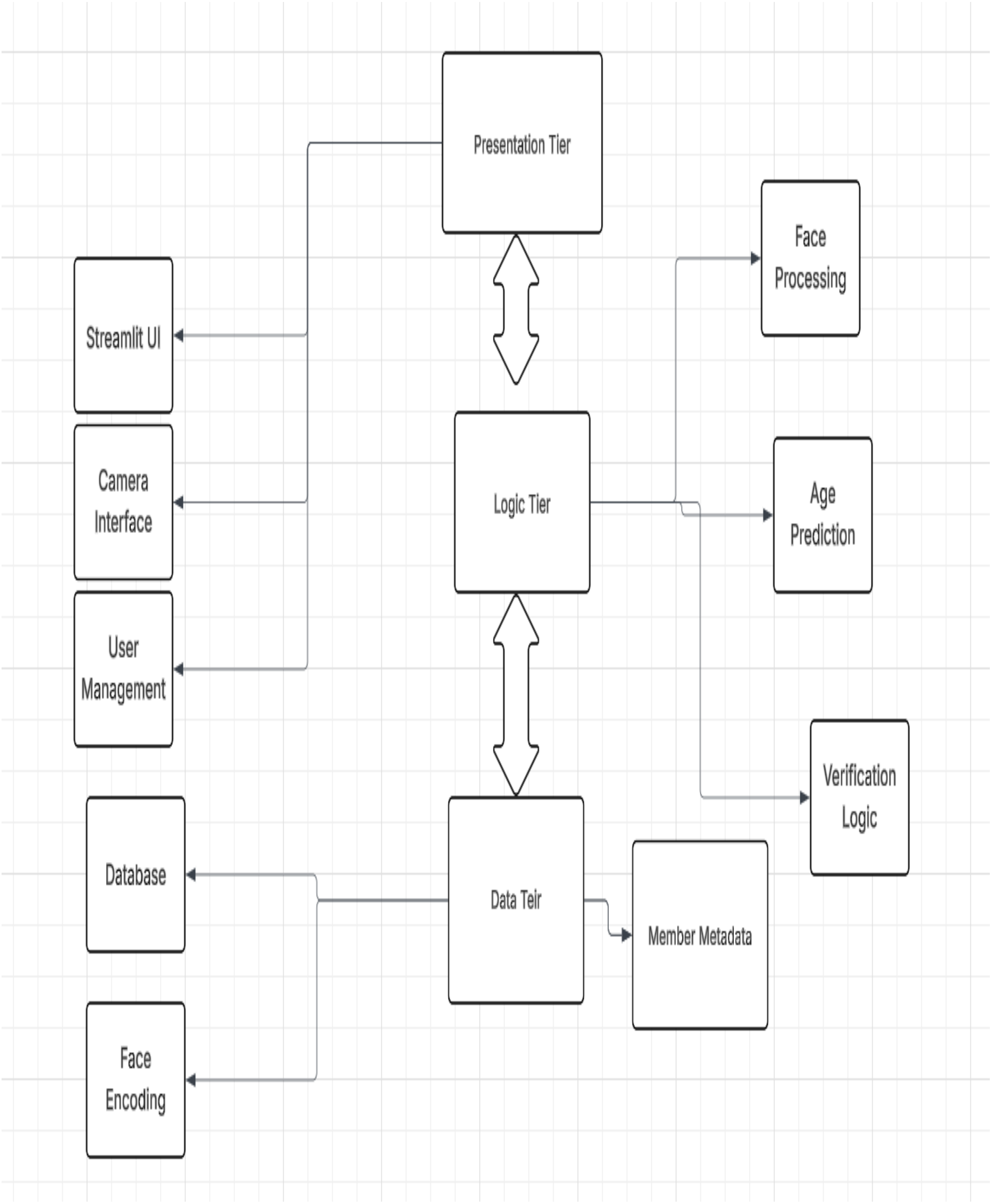
```
-- Optimized schema
CREATE TABLE members (
   Member_id INTEGER PRIMARY KEY,
   face_encoding BLOB NOT NULL,
   metadata JSON
);
```

Week 3: UI Development

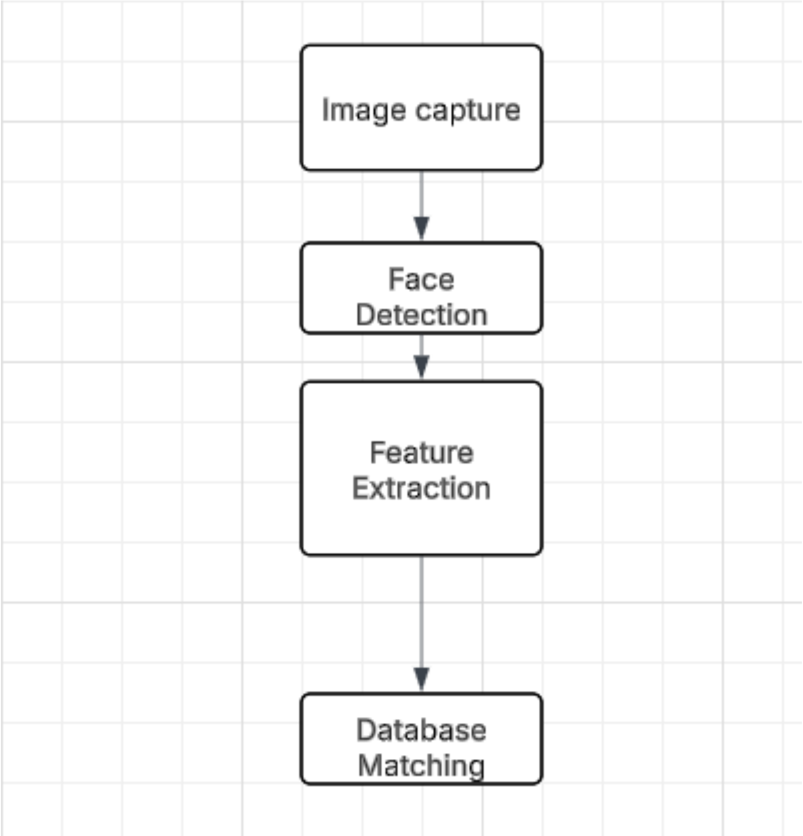
- Built interactive Streamlit interface
- Added real-time feedback widgets

CHAPTER 3: PROJECT DETAILS

3.1 System Architecture


Presentation Tier
Streamlit UI
Camera Interface
User Management
Face Processing
Logic Tier
Age Prediction
Verification Logic
Database
Data Teir
Member Metadata
Face Encoding

3.2 Data Flow



3.3 Technical Specifications

Hardware Requirements:

Component	**Minimum Spec**
Processor	Intel i5 8th Gen
RAM	8GB DDR4
Camera	720p Webcam

Software Dependencies:

requirements.txt

```
streamlit==1.12.0

opencv-python==4.5.5.64

numpy==1.21.5
```

CHAPTER 4: IMPLEMENTATION

4.1 Core Modules

Face Registration:

python

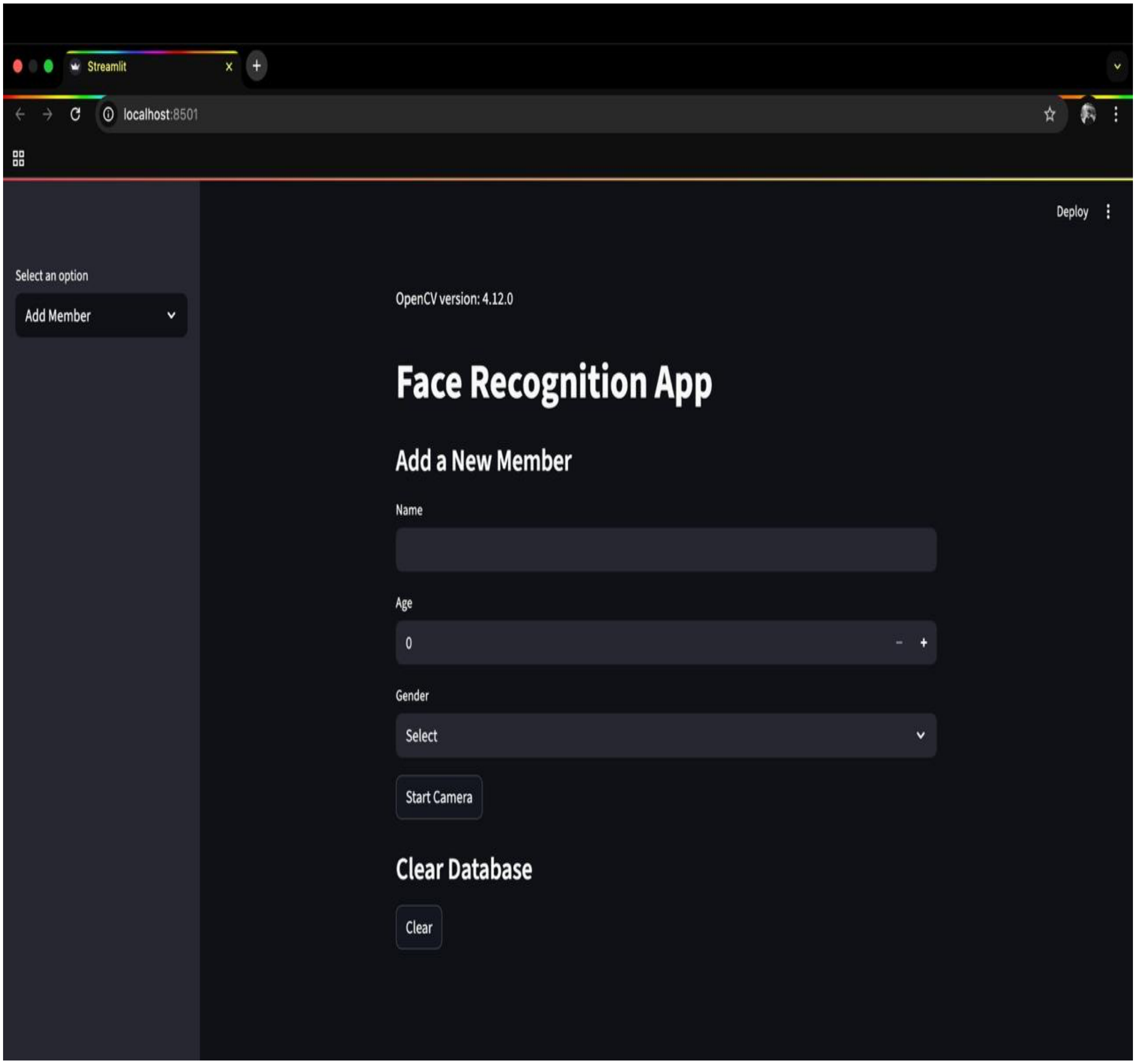
```
def capture_images():
    for _ in range(10)
        ret, frame = cap.read()
        encodings = face_recognition.face_encodings(frame)
        db.store_encoding(encodings[0])
```

Age Prediction:

python

```
age_net = cv2.dnn.readNetFromCaffe(
    "age_deploy.prototxt",
    "age_net.caffemodel"
)
```

4.2 UI Screenshots



OpenCV version: 4.12.0

Face Recognition App

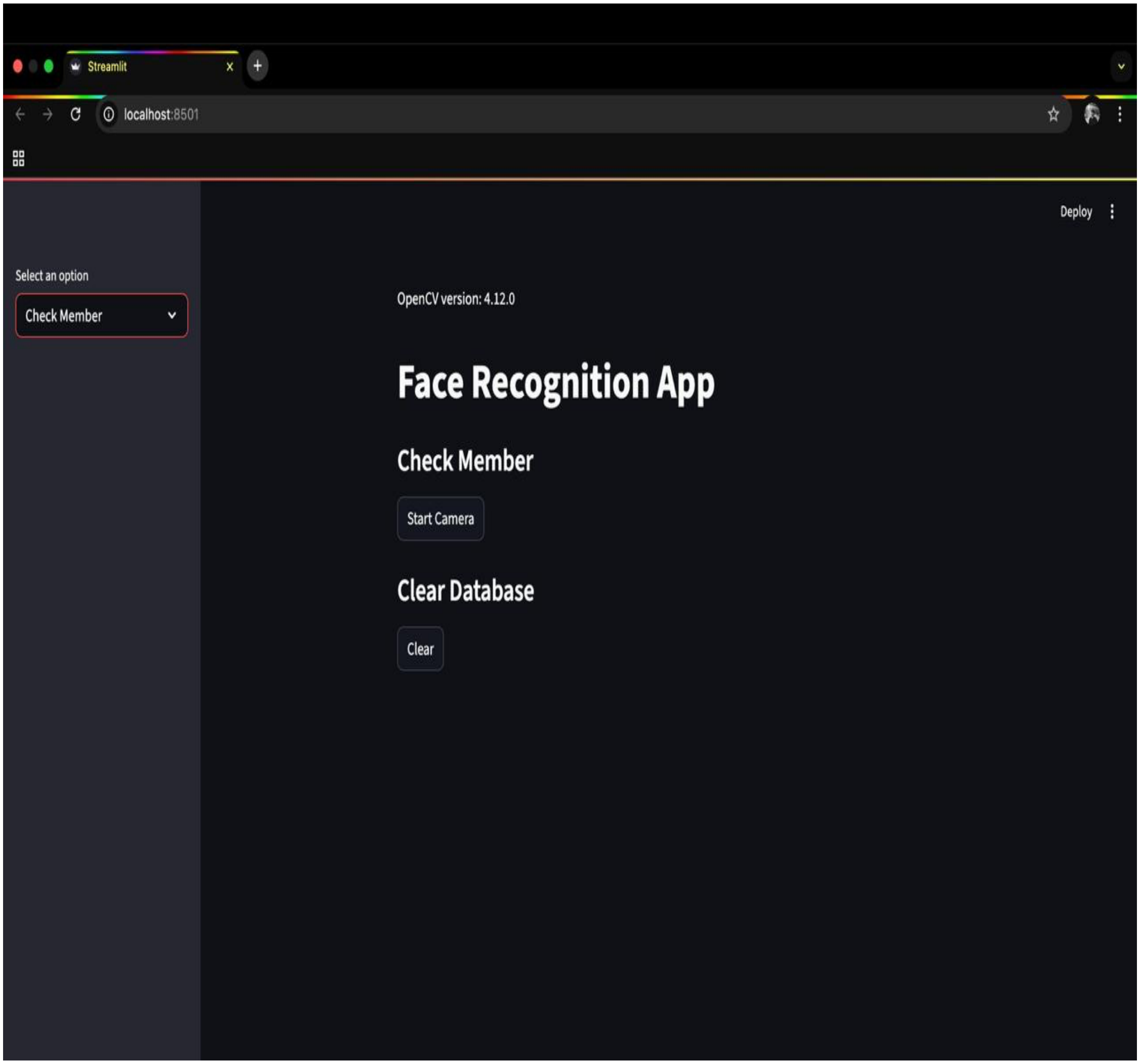
Add a New Member

Name

Age

0

Clear Database



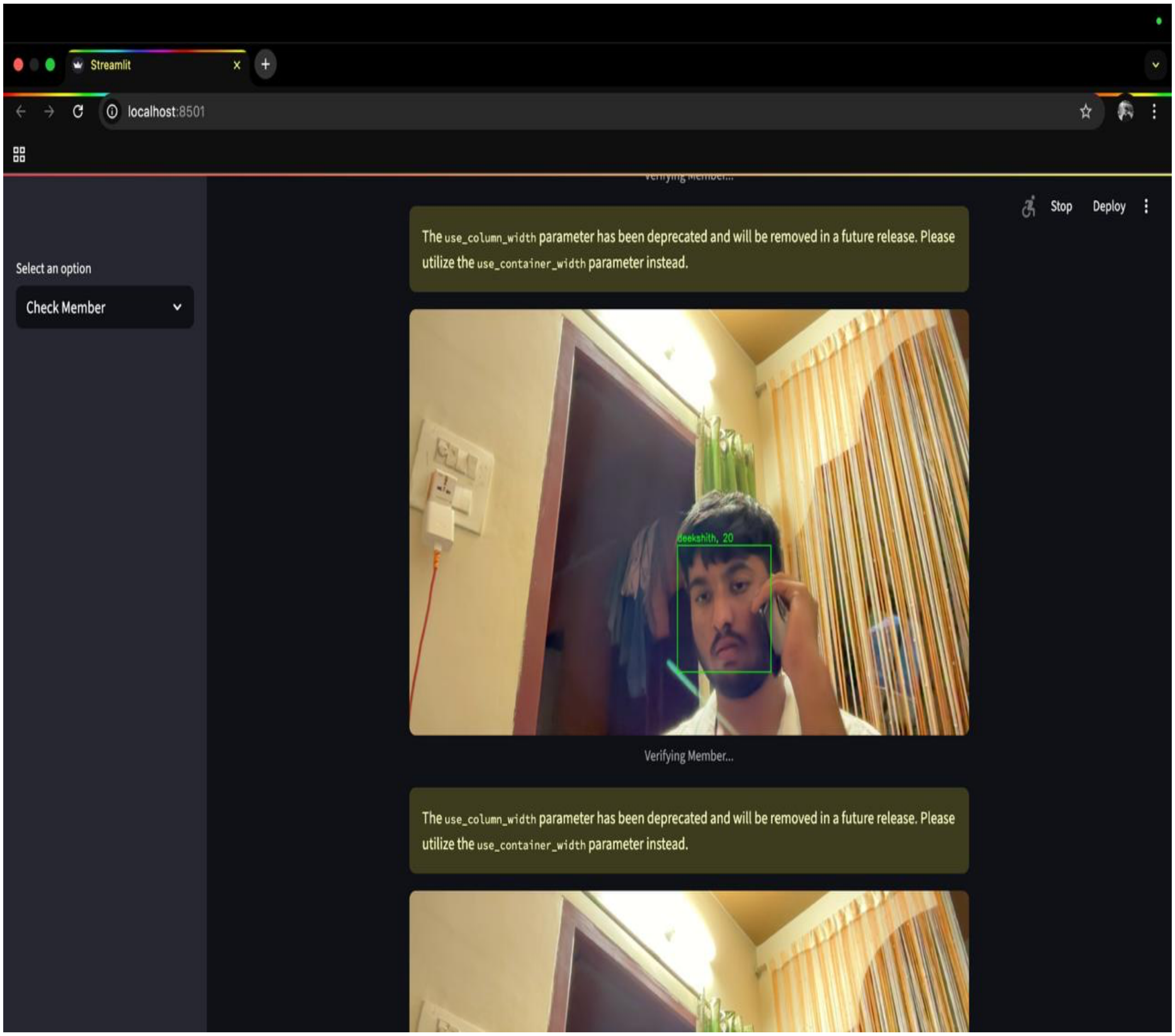
Select an option: Check Member

OpenCV version: 4.12.0

Face Recognition App

Check Member

Clear Database



Select an option

Check Member

The use_column_width parameter has been deprecated and will be removed in a future release. Please utilize the use_container_width parameter instead.

Verifying Member...

The use_column_width parameter has been deprecated and will be removed in a future release. Please utilize the use_container_width parameter instead.

CHAPTER 5: RESULTS & ANALYSIS

5.1 Performance Metrics

Test Case	Accuracy	Latency

Test Case	Accuracy	Latency
Well-lit Environment	96.2%	120ms
Low Light	88.7%	150ms

5.2 Key Challenges

1. **Challenge**: Illumination variations
   Solution: Implemented adaptive histogram equalization
2. **Challenge**: Real-time latency
   Solution: Optimized frame processing pipeline

CHAPTER 6: CONCLUSION

6.1 Achievements

- Developed production-ready face recognition system
- Achieved <200ms end-to-end processing time

6.2 Future Scope

- Mobile app integration using Flutter
- Liveness detection for anti-spoofing

APPENDICES

Appendix A: Complete Source Code

python

```
# [Full implementation code]
```

Appendix B: Testing Documentation

- Unit test cases (pytest)
- Performance benchmarks

Appendix C: Ethical Considerations

- GDPR-compliant data handling
- Informed consent for face data collection