Bangabandhu Sheikh Mujibur Rahman Digital University, Bangladesh

Faculty of Cyber Physical System

Dept. of Internet of Things and Robotics Engineering (IRE)

Course Title: Real life in IoT Lab

Course Code: IOT 4316

Lab Report-11

Submitted to-

Teacher name: Nurjahan Nipa

Designation: Lecturer

Department: IRE

Submitted by-

Md. Shahriar Hossain Apu (1901036)

Date of Submission: 12-10-2023

Task: Control LED through Face Recognition and Identification.

Introduction

The Face Recognition and Identification system is designed to demonstrate a practical application of computer vision and machine learning in controlling hardware. In this project, OpenCV and Python are used for face detection and identification, while Arduino is employed to control an LED. The system consists of three major components:

- Camera: Captures real-time video frames.
- Python with OpenCV: Processes the frames to detect and identify faces.
- Arduino: Controls an LED based on the identified person.

The objectives of this project include:

1.Detecting faces in a video stream using OpenCV.

2.Identifying the person by comparing detected faces with pre-trained images.

3.Controlling an LED based on the identity of the person detected.

Materials

1. Arduino UNO board.
2. Camera.
3. LED.
4. Jumper wires.
5. Breadboard.
6. Arduino connector.

Circuit Diagram
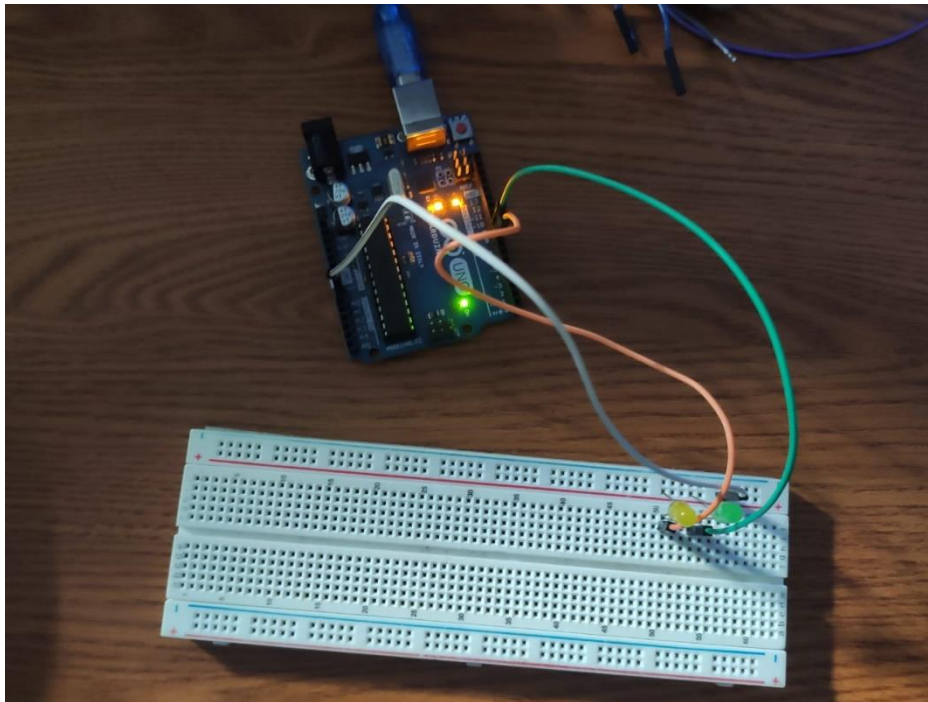
Fig: Circuit Diagram of controlling LED through Face Recognition and Identification.

Methods

1.Face Detection with OpenCV:

- Use Python and OpenCV to capture video frames from the camera.
- Apply face detection using Haar Cascades or a pre-trained deep learning model.
- Draw bounding boxes around detected faces.

2.Face Identification:

- Compare the detected face with a pre-trained dataset of known individuals.
- Use a face recognition algorithm to identify the person.
- Display the name of the identified person on the video feed.

3.Arduino and LED Control:

- Establish a serial connection between Python and Arduino using the PySerial library.

- Send commands from Python to Arduino to control the LED.
- Turn on the LED if a known person is identified; otherwise, keep it off.

4.User Interface:

- Create a user interface to start and stop the face recognition system.

Provide feedback to the user regarding the system's status.

Operational view
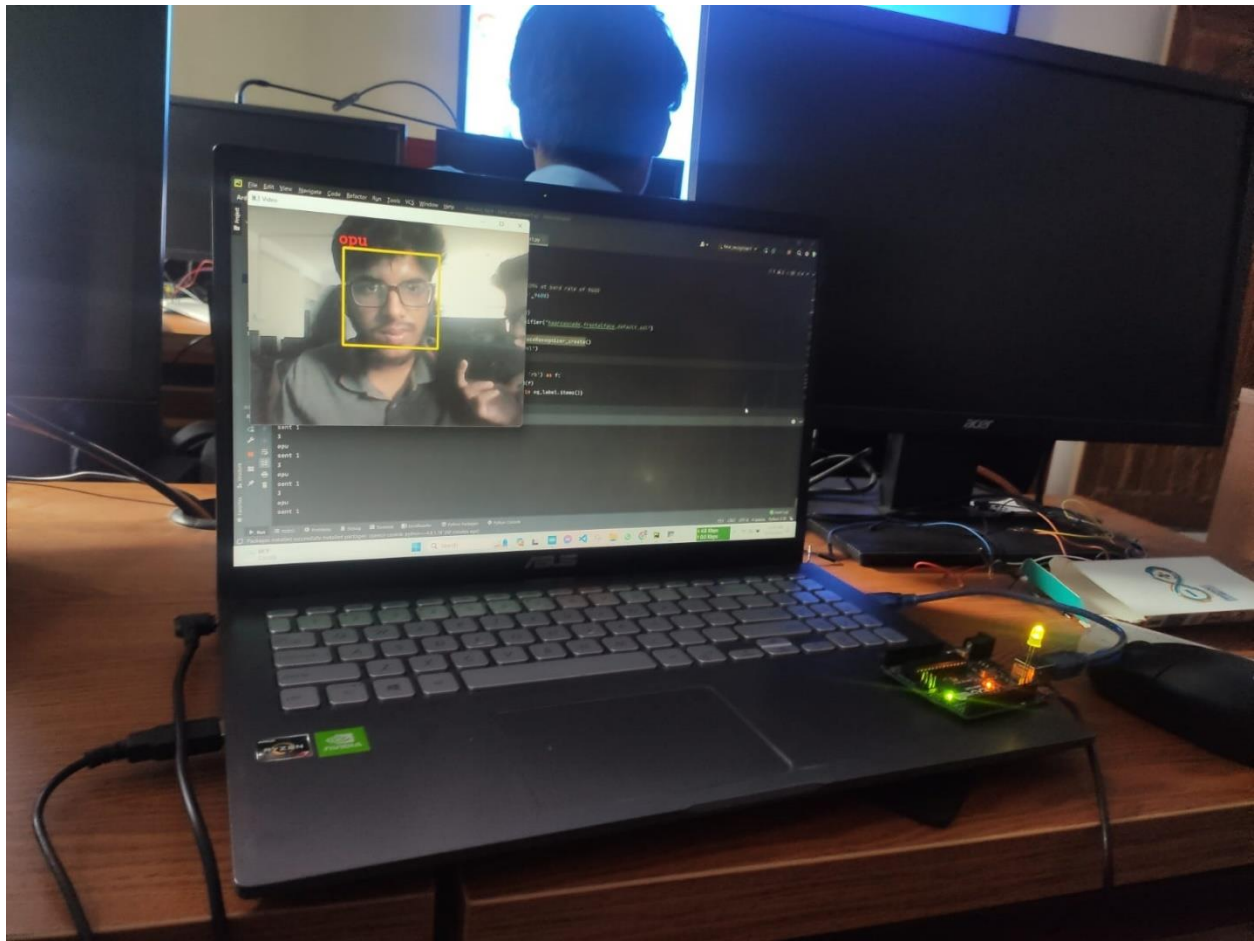
Fig: Implementational view of controlling LED through Face Recognition and Identification.

Discussion

This project successfully demonstrated the integration of computer vision, machine learning, and hardware control. However, there are some limitations and areas for improvement:

I.   **Speed and Efficiency:** The real-time performance of the system may be affected by the computational resources of the computer. Optimizing the code for faster processing is essential.

II. **Recognition Accuracy:** The accuracy of face recognition depends on the quality of the pre-trained dataset. Updating the dataset with more images and retraining the model can enhance recognition accuracy.

III. **Security Concerns:** The system should be further developed with security in mind, as face recognition applications can have privacy and security implications.

IV. **Scalability:** This system currently recognizes only a limited number of people. Scaling up to handle a larger database of individuals would be an interesting challenge.

GitHub Link: https://github.com/Shahriar-Hossain-Opu/Face-Recognition-and-Identification-Arduino-Face-ID-Using-OpenCV-Python-and-Arduino

Conclusion

The Face Recognition and LED Control system successfully demonstrated the integration of OpenCV, Python, and Arduino in a practical application. It can be a foundation for more advanced and secure systems in the fields of security, access control, and automation. The project highlighted the potential for combining computer vision and hardware control to create intelligent and responsive systems.

–End of the Report–