Design and Implementation of Identity Confirmation of Individuals based on Faces

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Part I: Introduction

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Part II: Implementation

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Part I

Introduction

Concepts

- **Access control systems** [1]
  - Identification
  - Authentication
  - Authorization

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Concepts

Access Control Systems

- Biometrically verified identity check
- Unique characteristics of the human face
- Extracting features (AI and Deep Learning)
- Results in automated businesses

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Concepts
Identification

- **Identify the presence of an individual**
- **Face recognition algorithm**
  1. Histogram of Oriented Gradients (object detection) [2]
  2. Landmarking model
  3. Face mapping to 128-D vector of features (ResNet v1)

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Concepts
Authentication

- **Authenticate the person's identity**
- **Server confirmation**
  1. Read registered faces' features
  2. Compare loaded features (0.6 threshold)
  3. Confirmation or Denial

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- **Grant or Deny access**
  - Actuator
  - Playing a sound
  - Notification

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Part II

Implementation [3]

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Parts
Overview

- **Hardware**
  - Board
  - Camera
  - Modem
  - Server
- **Software**
  - OS
  - Board's service
  - Server application (API)
  - Notification system
  - Database

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Parts
Hardware

- **Board**
  - Raspberry Pi 4
  - Cortex-A72 (ARM V8), Audio output, LAN, USB, Camera port
- **Camera**
  - Raspberry Pi NoIR Camera v2
  - No infrared filter (NoIR)
  - 8 Megapixel
- **Modem**
- **Server**

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Parts
Software

- **OS**
  - Pi OS
  - Based on Debian
- **Board's service**
  - Systemd service manager
  - Permanently running
- **Server application (Django)**
- **Notification system**
  - Email notification
  - Email template
- **Database**
  - PostgreSQL
  - Verified, Log Tables

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References

[1] FaceMe, "[guide] facial recognition technology for access control systems," (), [Online]. Available: https://www.cyberlink.com/faceme/insights/articles/473/build-an-access-control-system-with-facial-recognition-technology.

[2] O. Déniz, G. Bueno, J. Salido, and F. D. L. Torre, "Face recognition using histograms of oriented gradients," *Pattern Recognition Letters*, vol. 32, pp. 1598–1603, 12 Sep. 2011, ISSN: 0167-8655. DOI: 10.1016/J.PATREC.2011.01.004.

[3] M. Moradi and A. Abdi, "Design and implementation of identity confirmation of individuals based on faces," bachthesis, K. N. Toosi University of Technology, 2023.

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