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TrustID 

TRUSTID Multiplier Event at the University of Patras

Intellectual Output 2 - Design and Implementation of Open-source Privacy-preserving Toolkit and Application Programming Interfaces

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Cognitive UX GmbH



University
of Cyprus



cognitiveux

Intellectual Output 2 (IO2)

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- Design and Implementation of Open-source Privacy-preserving Toolkit and Application Programming Interfaces
- *Lead:* Cognitive UX GmbH
- *Participating Partners:*
 - University of Patras
 - University of Cyprus
 - University of Coimbra ISR
- *Output type:* Services / structures – E-learning platform
- *Media:* Software, Service, Publications

IO2 – Key Objectives

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- **Implement the algorithms** for continuous user identification based on a mixed model of voice, face and user interaction analytics
- **Preserve the privacy** of utilized user biometric data
- Design and develop an **open-source Identity-as-a-Service solution**
- Design and develop an **interactive dashboard** for service integration and analytics

IO2 - Tasks and Task Leaders

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- Task 2.1: Architecture Design
 - **Lead: Cognitive UX GmbH**
 - *Participating:* University of Patras, University of Cyprus, University of Coimbra
- Task 2.2: Privacy-preserving Biometrics
 - **Lead: University of Cyprus**
 - *Participating:* University of Patras, University of Coimbra, Cognitive UX GmbH
- Task 2.3: Development of Voice-, Image- and Interaction-based Algorithms
 - **Lead: Cognitive UX GmbH**
 - *Participating:* University of Patras, University of Cyprus, University of Coimbra
- Task 2.4: Integration and Verification Testing
 - **Lead: Cognitive UX GmbH**
 - *Participating:* University of Patras, University of Cyprus, University of Coimbra

Task 2.1: Architecture Design

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- This task started early in the project accompanying the work of the development-related tasks
- **Design the architecture of the framework** by defining the technical infrastructure, standards, specifications and strategies to be followed throughout the development and testing of the framework

Task 2.2: Privacy-preserving Biometrics

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- Develop methods for **preserving the privacy of the data** used for continuous student identification
- Main aim is to identify the students based on their biometric data (voice, face, interaction behavior), **without disclosing sensitive information about the students**
- **Existing weaknesses and threats** with regards to privacy in biometric-based user identification will be studied
- **Novel methods** designed and developed to preserve the privacy of the students' biometric-based data

- Develop the mechanisms for identifying users from voice-, image- and interaction-based data
- **Voice-based user identification**
 - Voice data is collected through built-in microphone devices
 - Identify users in real-time using raw voice data streams by applying state-of-the-art machine learning techniques (*e.g.*, Gaussian Mixture Models)
- **Image-based user identification**
 - Process real-time video data collected through low-cost Web-based camera devices
 - Face biometrics performed through face recognition and analysis
- **Interaction-based user identification**
 - The mechanism considers the relevance of individual keyboard interaction patterns in real-world settings while learners perform free text tasks
 - Model the end-users' keystroke dynamics with novel machine learning techniques

Task 2.4: Integration and Verification Testing

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- **Integrate the various components** developed into a complete integrated platform
- This process entails several iterations leading to a full-fledged implementation of the project, which will be thoroughly evaluated within IO3
- **Integrate TRUSTID within the existing LMS** of the participating HEIs in order to be able to proceed with the evaluation studies
- **Verification testing:** Develop techniques and tools to show that the security metrics, policies and continuous identification methods satisfy the classical set of identification properties

Summary of Achievements

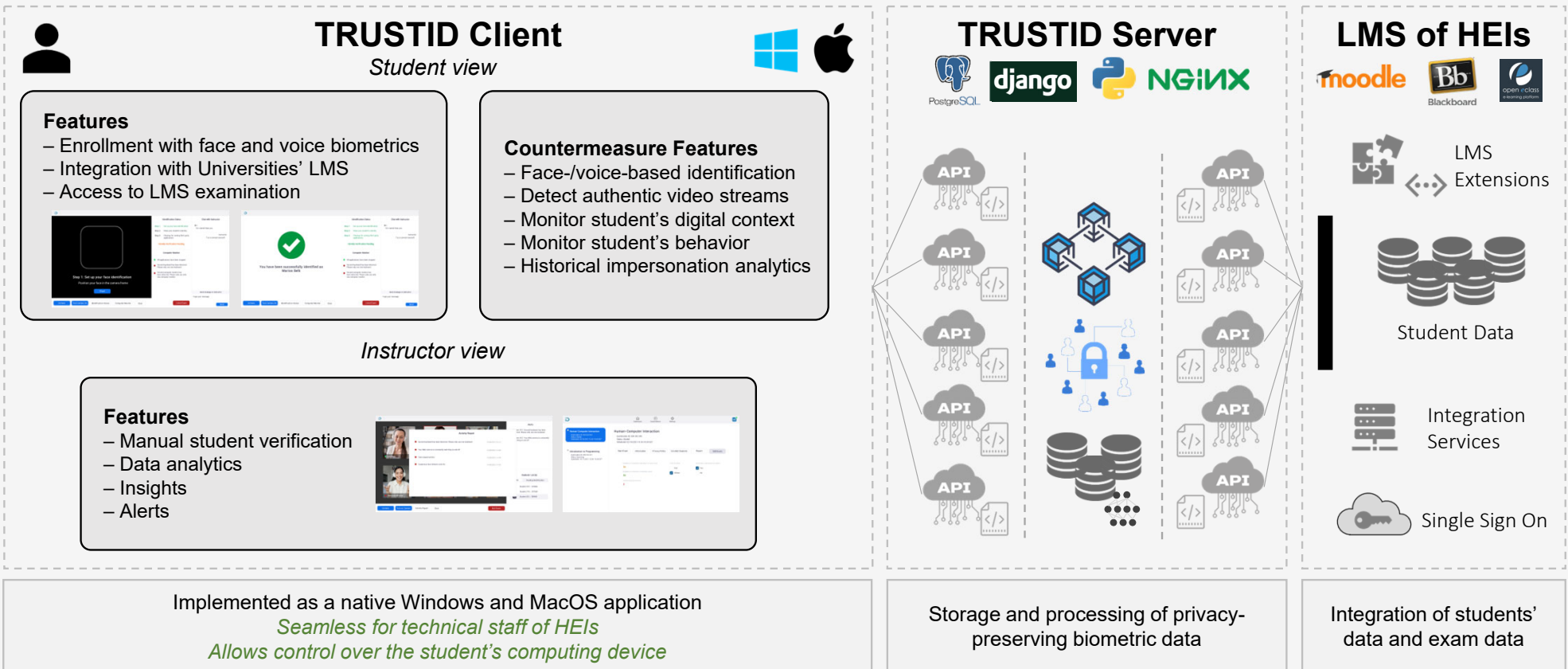
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- Designed and developed the TRUSTID platform and associated tools and mechanisms for continuous student identification
- The TRUSTID system consists of the following components:
 - **Native client software applications** (implemented as both native Windows and MacOS applications), enabling students and instructors to interact with the implemented mechanisms of TRUSTID
 - **Back-end system**, which consists of an **Application Programming Interface**, which exposes a series of system end-points of TRUSTID
 - **User identification enrollment mechanisms enabling end-users to enroll in the TRUSTID system** through recording of face-based images and voice stream that are used for training the biometric models
 - **Machine learning-based algorithms** and mechanisms for user identification
 - **Privacy-preserving** biometric smartphone wallet
 - **Integrated all the technologies** under interoperable platform
 - **LMS integration** with Moodle
 - **Examination Management** for Instructors

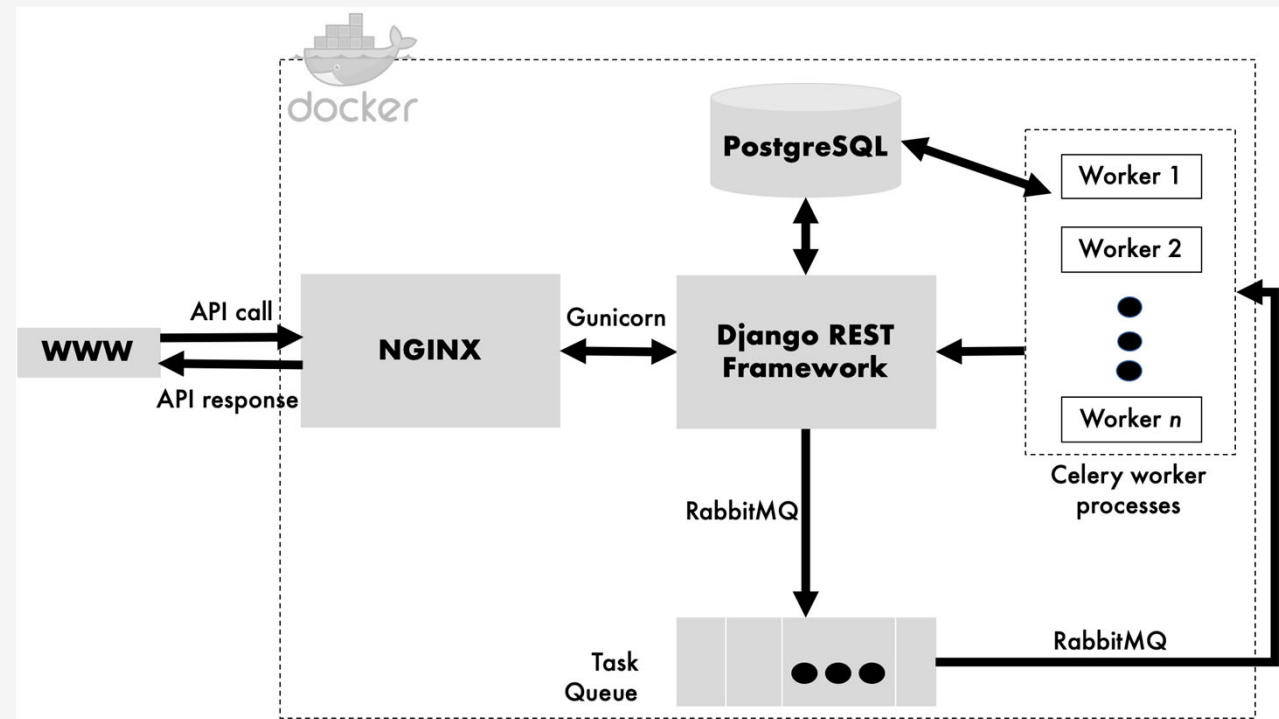
TRUSTID Framework

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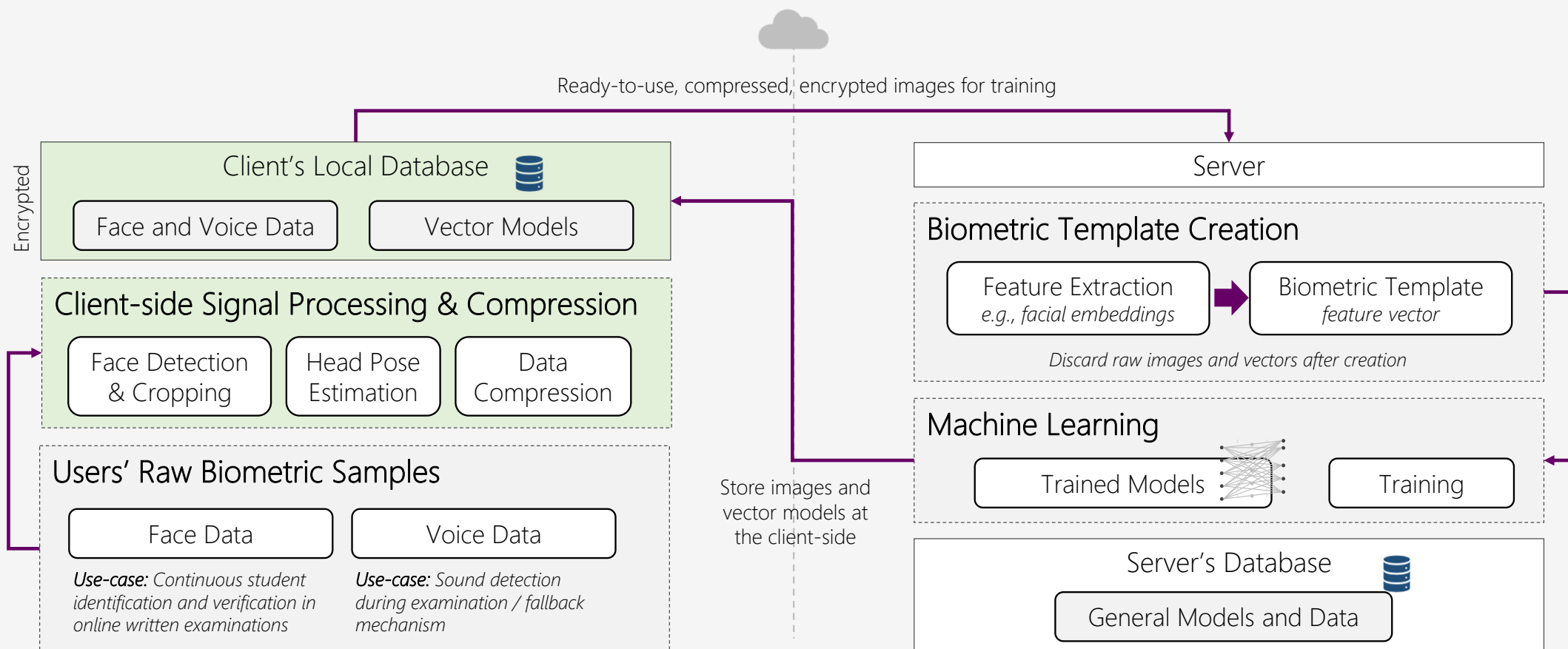


Architectural Design and Technology Stack

- Server-side **web API**
- **Django** REST Framework
- **NGINX** (Web server, Reverse proxy, Load balancer)
- **Gunicorn** (Application server that implements the Web Server Gateway Interface)
- **Celery** (Asynchronous task queue based on distributed message passing)
- **RabbitMQ** (Message broker)
- **PostgreSQL**
- **Docker**



Framework for Privacy-preservation



Client Application

Windows and MacOS

Integrated Login

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TRUSTID :: Intelligent Student Identity Management

TRUSTID

Email

Password

Organization

- University of Cyprus 
- University of Patras 
- University of Coimbra 

Login

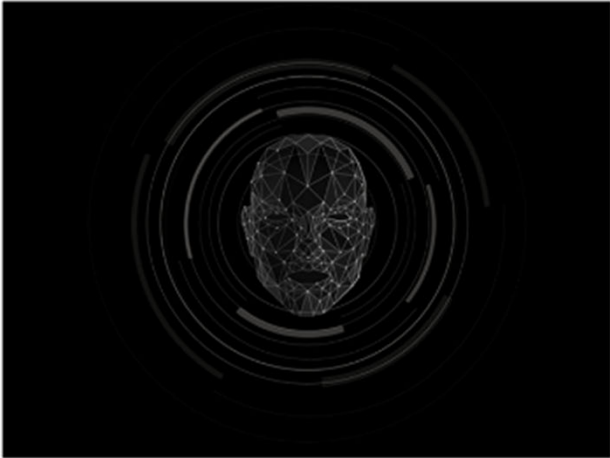
Register Face Biometrics

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Face Enrollment

Register Face Biometrics



TRUSTID needs your consent to collect your face data
Please select I consent to continue

I consent

Cancel Enrollment

Biometrics Process


- Step 1 - Consent
- Step 2 - Face Biometrics

Biometrics Ready

Previous Versions - Web-based Enrollment

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TRUSTID - Proof of Concept 1 User Evaluation

Phase 1: Creation of Computational User Identification Models

Step 1: Enter email

Email (same email used during subscription)

I agree to the processing of my personal data in accordance to the TRUSTID [privacy policy](#)

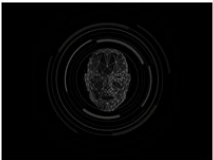
Continue

Progress

- Provide email address
Step 1
- Start Web camera and perform checks
Step 2
- Record face data
Step 3

Your Web Camera

Your Web camera is switched off

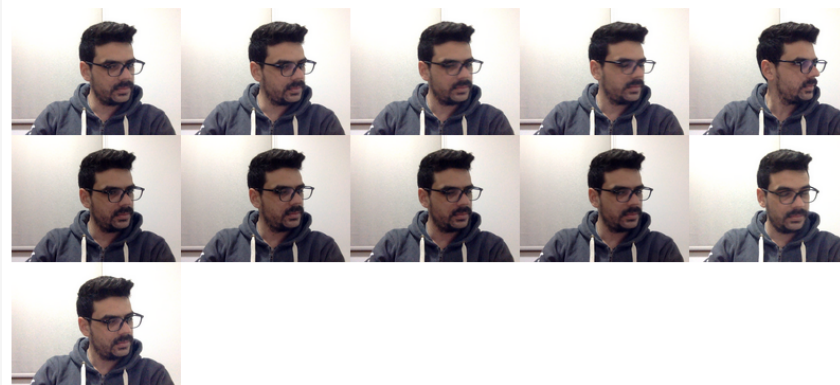


Participant Images - TRUSTID First Proof of Concept Evaluation Study

Name: Argyris Constantinides

Left Facing **Right Facing** **Forward Facing** **Upward Facing** **Downward Facing** **LOGOUT**

Classified correctly: 11 items



Misclassified: 45 items




Register Voice Biometrics

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Voice Enrollment

Register Voice Biometrics



TRUSTID needs your consent to collect your voice data
Please select I consent to continue

I consent

Cancel Enrollment

Biometrics Process
Step 1 - Consent
Step 2 - Voice Biometrics

Biometrics Ready

Control and Manage Biometrics

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TRUSTID :: Intelligent Student Identity Management

Dashboard Examinations Biometric Models AC

Edit Biometrics

Actions

 Voice Created on: 06/12/2022 12:47:50	Update Delete
 Face Created on: 06/12/2022 12:48:50	Update Delete

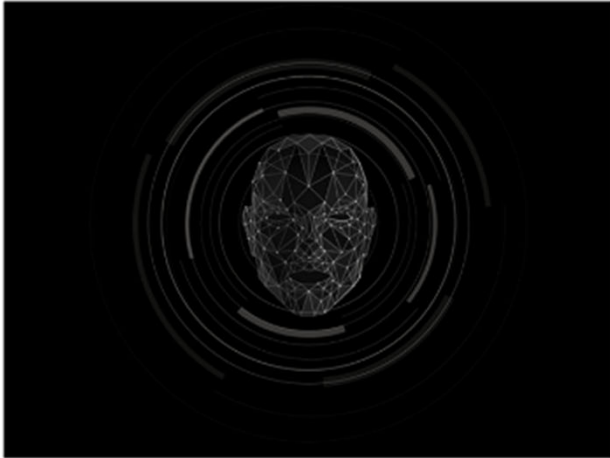
Continuous Face Identification

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Face Identification

Face-based Identification



TRUSTID will identify you based on your face characteristics
First, position your face in the camera frame

[Get Started](#)

Identification and Verification Process

- Step 1 - Face-based identification
- Step 2 - Voice-based identification
- Step 3 - Checkup for third-party applications

Identity Verification

[Cancel](#)


Continuous Voice Identification

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Voice Identification

Voice-based Identification



Your voice is now being recorded - Please speak loudly and clearly

Capture **Cancel**

Identification and Verification Process

- Step 1 - Face-based identification
- Step 2 - Voice-based identification
- Step 3 - Checkup for third-party applications

Identity Verification

Digital Written Examination Scenario

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Written Examination

Multiple Choice Questions

What does the ERASMUS acronym stand for?

- European Committee Agency Scheme for the Mobility of University Students
- European Community Action Scheme for the Mobility of University Students
- European Continental Agility Scheme for the Mobility of University Students
- European Congress Ambassador Scheme for the Mobility of University Students

Monitoring

- Camera capture is enabled
- Voice capture is enabled
- Checkup running applications is enabled

TRUSTID will periodically capture your photo and voice for continuous identification purposes and will checkup the running applications and processes on your computer

User Feedback Mechanism

- I will impersonate with another person
- I will open a forbidden application

Send Feedback

Close Exam




Oral Examination Scenario

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Oral Examination

Oral Examination in Progress



Start Voice Capture

Stop Voice Capture

Monitoring

Camera capture is enabled

Checkup running applications is enabled

TRUSTID will periodically capture your photo and voice for continuous identification purposes and will checkup the running applications and processes on your computer

User Feedback Mechanism

I will impersonate with another person

I will open a forbidden application

Send Feedback

Close Exam

Examination Management Dashboard

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TRUSTID :: Intelligent Student Identity Management

Dashboard Examinations Management

Management

Add a new exam Add Exam

Edit existing exams Edit Exams

Enroll students to exam Enroll

Examination Management

Add Exam


Additional Material Yes No

Exam Duration:

Exam Type:

Name:

Privacy Policy

Scheduled date 

Edit Exam

Name	ID	Date	Enrolled Students
Introduction	61667302972	07/12/2022 00:00:00	59

LMS Integration and Synchronization Tools

Upload and Enroll to Exam

Upload and Enroll Students:

Upload students:

C:\Users\laryr\Downloads\test_users (1).csv

First name	Last name	Email
Adamos	Adamou	aadamou@live.com

Exam id	Exam name
61667302972	Introduction to F

Select Exam:

61667302972

Select all students: Yes

All students selected

View Enroll Students

Students Enrolled in Exam: Introduction

First name	Last name	Email
Christou	Panikos	panikoschristou@yahc
Georgiou	Mariaeleni	mgeorg04@ucy.ac.cy
Panagi	Paraskevi	ppanag03@ucy.ac.cy
Tsakilioti	Evangelia	euatsakilioti@gmail.co
Tzamou	Maria	mtzamo01@ucy.ac.cy
Sofocleous	Elena	sofocleous.elena@ucy
Sofocleous	Elena	elenadepp1524@gma
Aristodemou	George	george.arist@gmail.co

TRUSTID Backend – Application Programming Interface

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TRUSTID API

[Base URL: localhost:11000/backend]
[http://localhost:11000/backend/swagger/]

The endpoints for interacting with the TRUSTID server

Terms of service
Contact the developer
BSD License

Scheme: HTTP

Django Login | Authorize

Filter by tag

- instructor**
 - POST /instructor/add_exam (instructor_add_exam_create)
 - POST /instructor/enroll_students (instructor_enroll_students_create)
 - GET /instructor/list_exam (instructor_list_exam_list)
 - POST /instructor/update_exam_details (instructor_update_exam_details_create)
- login**
 - POST /login (login_create)
- monitoring**
 - POST /monitoring (monitoring_create)
- refresh_token**
 - POST /refresh_token (refresh_token_create)
- register_user**
 - POST /register_user (register_user_create)
- student**
 - POST /student/identification (student_identification_create)
 - GET /student/list_exam (student_list_exam_list)
- trustid_version**
 - GET /trustid_version (trustid_version_list)
- update_exam_condition**
 - POST /update_exam_condition (update_exam_condition_create)

login

POST /login (login_create)

Creates a JSON Web Token if the provided credentials are correct

Parameters

Name	Description
data <small>required</small> (body)	<p>Edit Value Model</p> <pre>{ "email": "string", "password": "string" }</pre> <p>Cancel</p> <p>Parameter content type: application/json</p> <p>Execute</p>

Responses

Response content type: application/json

Code	Description
201	<p>JSON Web Token has been created successfully. The value is returned in <code>resource_obj</code>.</p> <p>Example Value Model</p> <pre>{ "message": "string", "resource_name": "string", "resource_obj": {} }</pre>

Web API – Documentation

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Search...

- Authentication
- instructor >
- login >
- monitoring >
- refresh_token >
- register_user >
- student >
- trustid_version >
- update_exam_condition >

Documentation Powered by ReDoc

instructor

instructor_add_exam_create

The view that allows instructors to add examinations

AUTHORIZATIONS: **Bearer**

REQUEST BODY SCHEMA: application/json

additional_material	boolean (Additional material)
duration <i>required</i>	integer (Duration in minutes) [0..9223372036854776000]
exam_type <i>required</i>	string (Exam type) Enum: "Oral" "Written"
privacy_policy <i>required</i>	string (Privacy policy) non-empty
scheduled_date <i>required</i>	string <date-time> (Scheduled date)

Responses

^ 200 Success

RESPONSE SCHEMA: application/json

message	string A general message description
resource_name	string The name of the resource

POST /instructor/add_exam

Request samples

Payload

application/json

```
{
  "additional_material": true,
  "duration": 0,
  "exam_type": "Oral",
  "privacy_policy": "string",
  "scheduled_date": "2021-12-13T13:28:55Z"
}
```

Response samples

200 400 401 403 404 405 415 500

application/json

```
{
  "message": "string",
  "resource_name": "string"
}
```

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TrustID 

Thank you!

Marios Belk, Cognitive UX GmbH



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