ARCADIAN-IoT

ARCADIAN TRAINING
BIOMETRICS COMPONENT

Julio Diez Tomillo (UWS)

15/09/2023

AGENDA

ARCADIAN-IoT

1. Introduction
2. Biometrics in the ARCADIAN-IoT framework
3. What is inside the Biometrics component?
4. Steps to perform face verification
5. Biometrics challenges
6. What can Biometrics achieve?
7. Legal considerations
8. Conclusions

INTRODUCTION

INTRODUCTION

ARCADIAN-IoT

- **Biometrics** widely used: border control airport, unlock smartphone…
- Always from close distances – not UAVs.
- **Face verification:** Compare two faces to determine if they belong to the same person.
- **Face recognition:** Match a face with a person contained in a database. Need of compare it with every person.
  - Slower
  - Iterative face verification
- Although biometrics can do both processes, in ARCADIAN only face verification is performed.

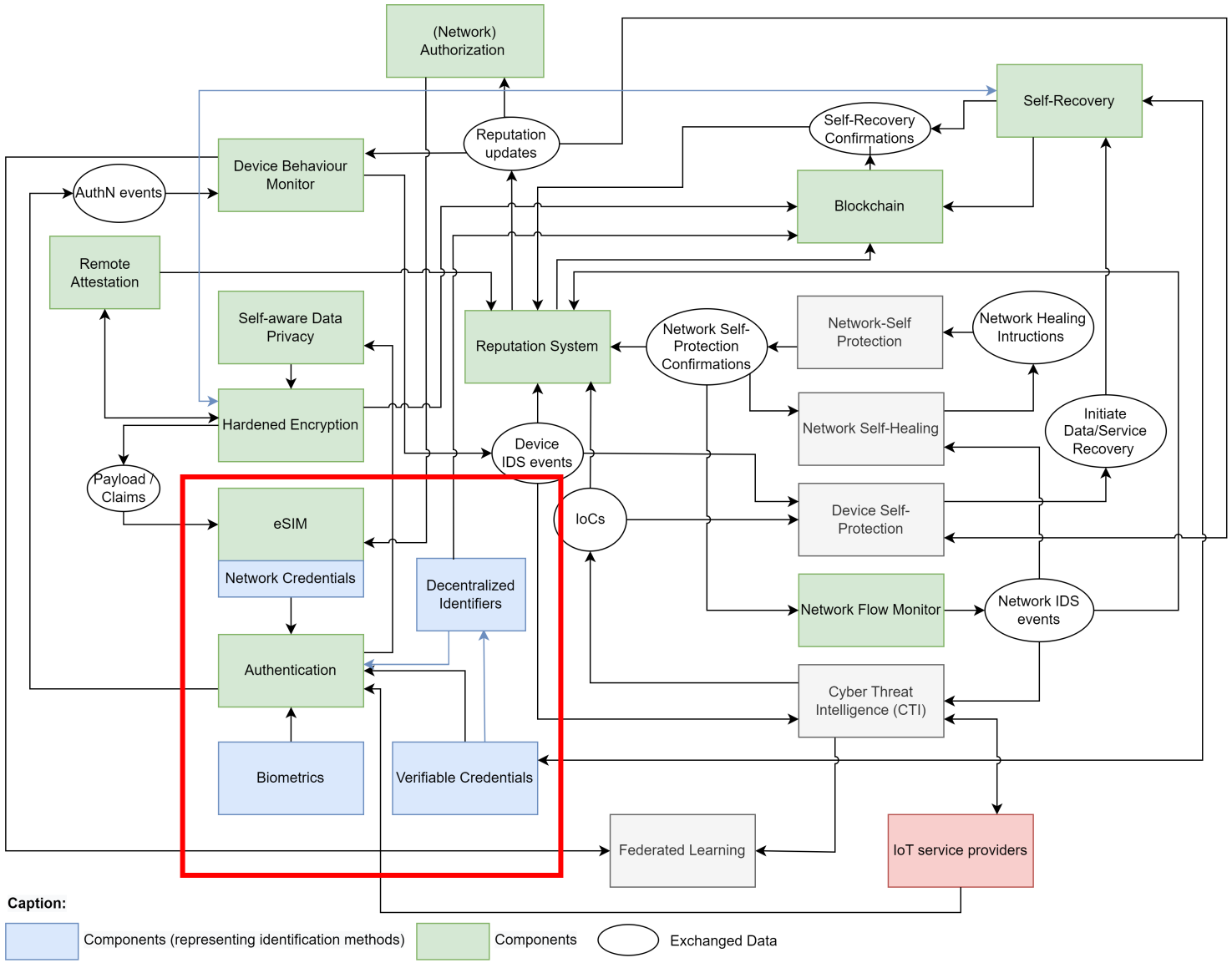
BIOMETRICS IN THE ARCADIAN-IOT FRAMEWORK

BIOMETRICS IN THE ARCADIAN-IOT FRAMEWORK

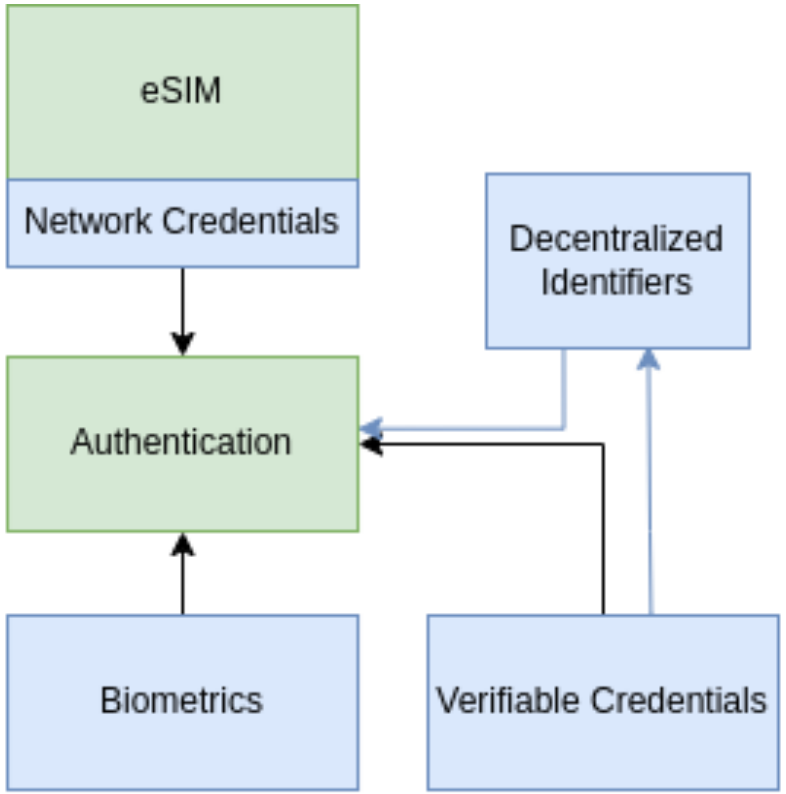
ARCADIAN-IoT

- Third authentication method – Part of the multifactor authentication.
- Face verification performed – Only need to identify one person.
- A user will be stored in our DB with a specific decentralized identifier (DID) for more privacy.
- When a person needs to be authenticated, Biometrics will receive the DID of that user and a picture containing a face to verify.
- The results will be sent to the multifactor authentication to continue with the authentication process.

BIOMETRICS IN THE ARCADIAN-IOT FRAMEWORK

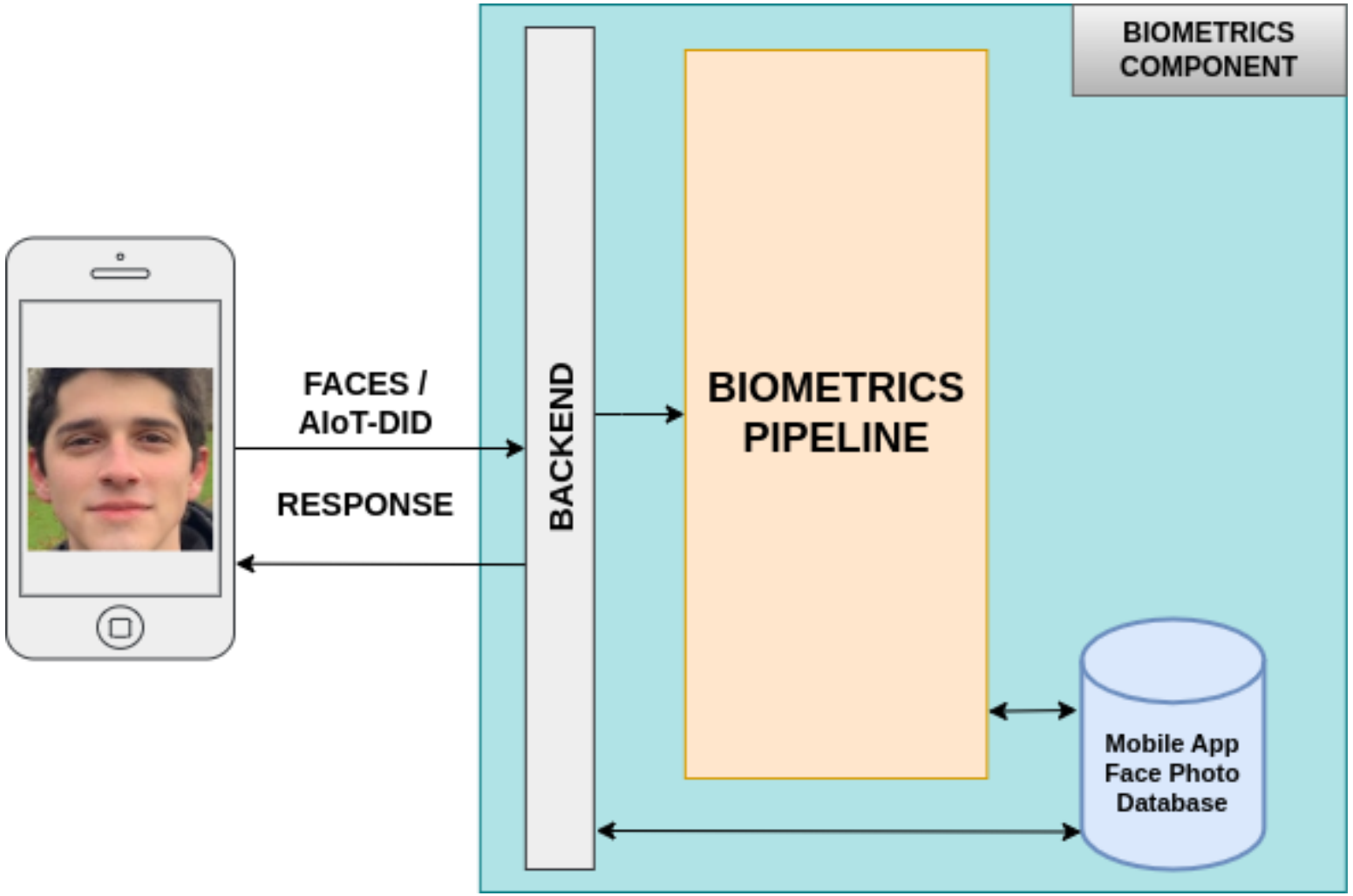


BIOMETRICS IN THE ARCADIAN-IOT FRAMEWORK

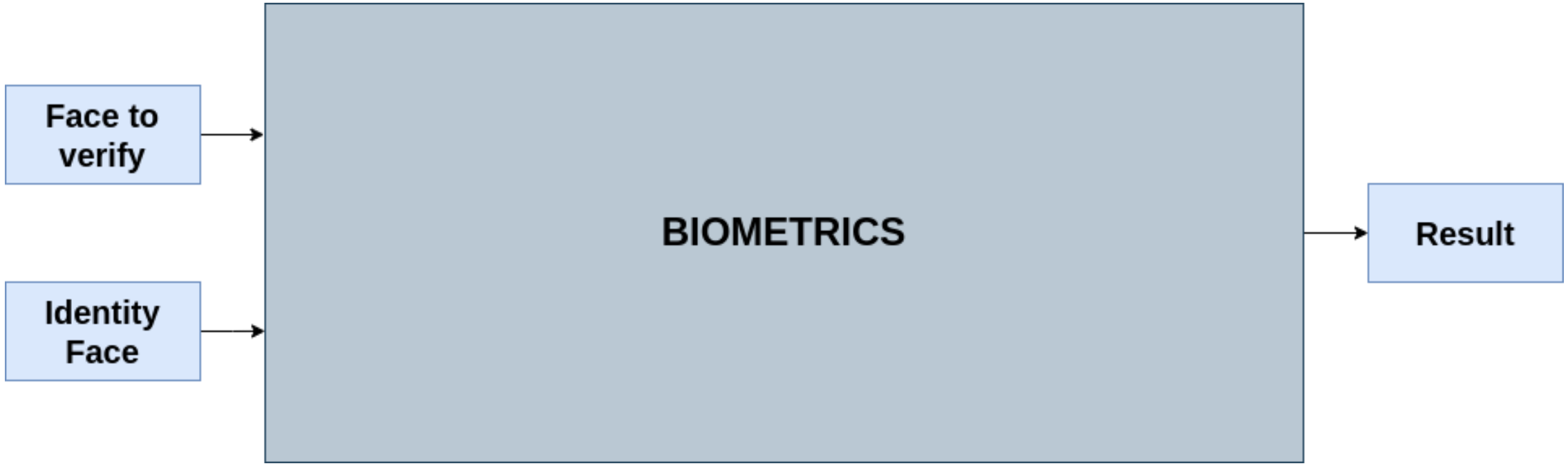


WHAT IS INSIDE THE BIOMETRICS COMPONENT?

WHAT IS INSIDE THE BIOMETRICS COMPONENT

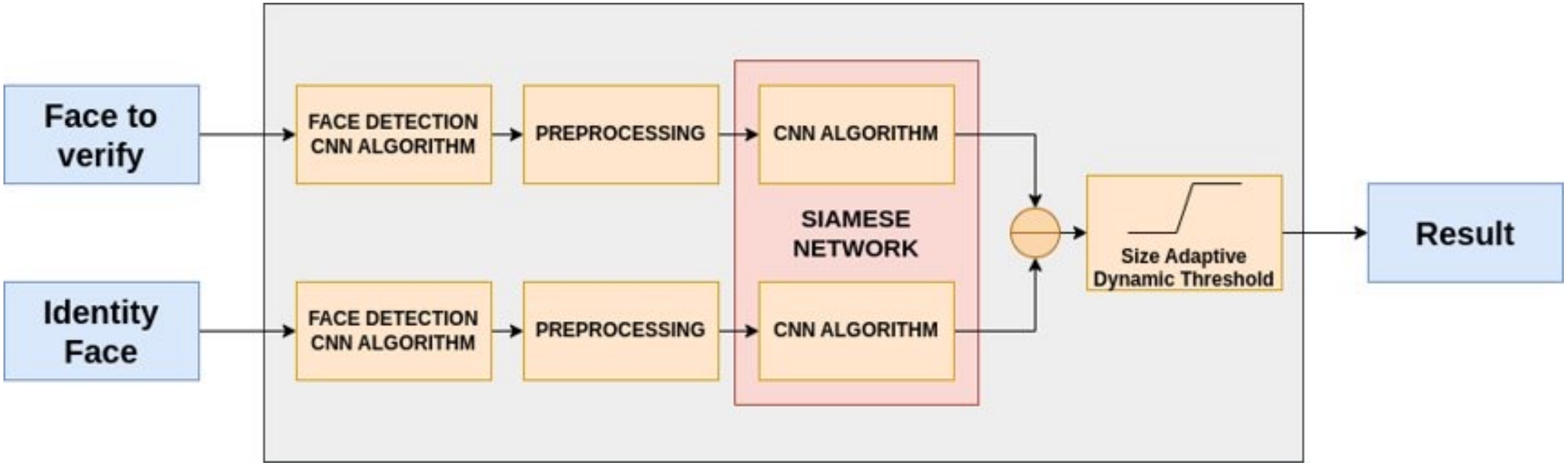


WHAT IS INSIDE THE BIOMETRICS COMPONENT



WHAT IS INSIDE THE BIOMETRICS COMPONENT

ARCADIAN-IoT



WHAT IS INSIDE THE BIOMETRICS COMPONENT

ARCADIAN-IoT

- INPUTS:
  - **Face to verify:** Face wanted to know if it belongs to that person.
  - **Identity face:** Face stored in the Database of that person in the registration process.
  - If the face to verify comes from a video, the identity face will only go through the first 3 blocks once at the beginning – It is the same face every iteration.
- OUTPUTS:
  - **Results:** If both faces belong to the same person or not.

STEPS TO PERFORM FACE VERIFICATION

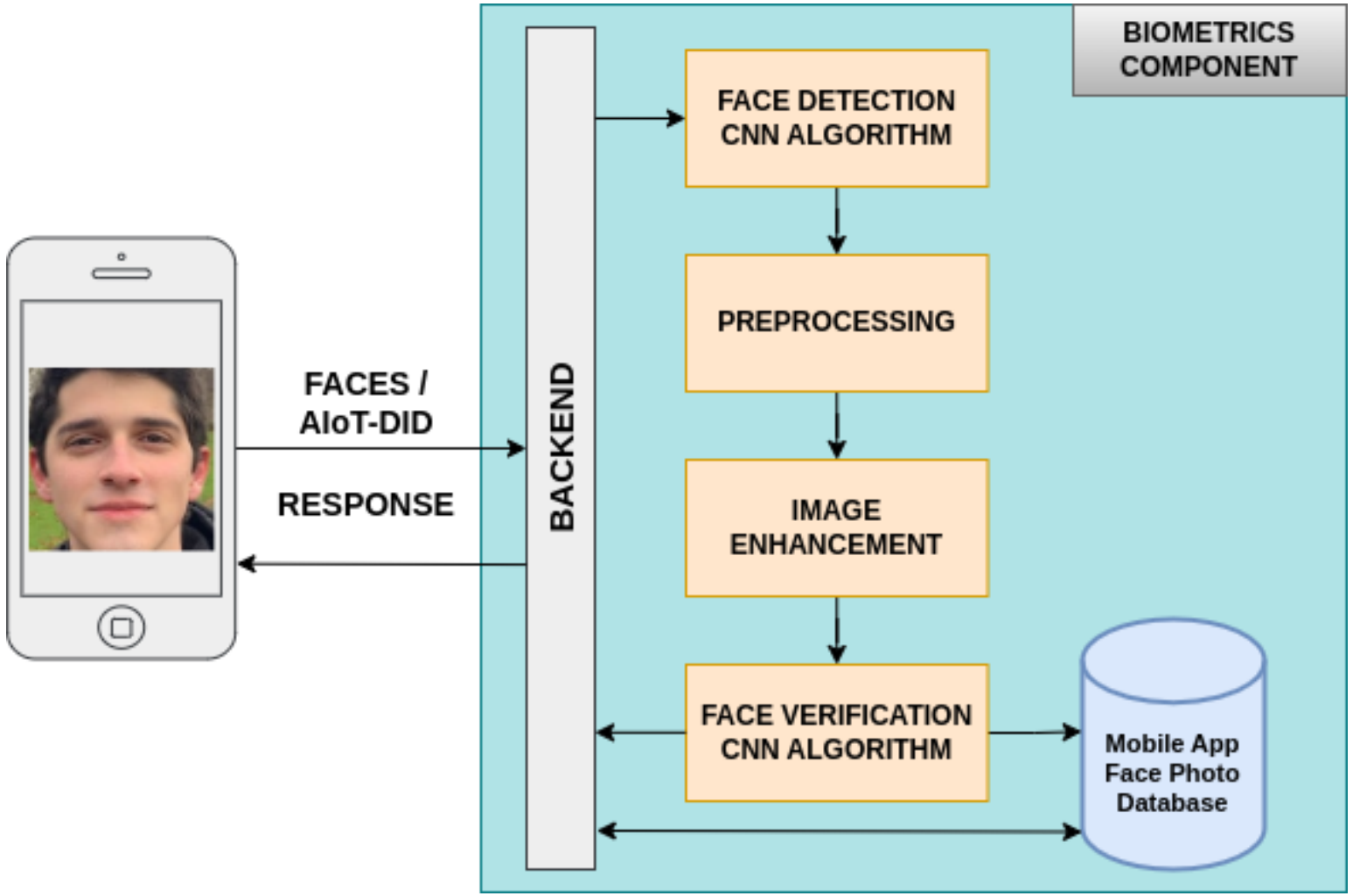
STEPS TO PERFORM FACE VERIFICATION

ARCADIAN-IoT

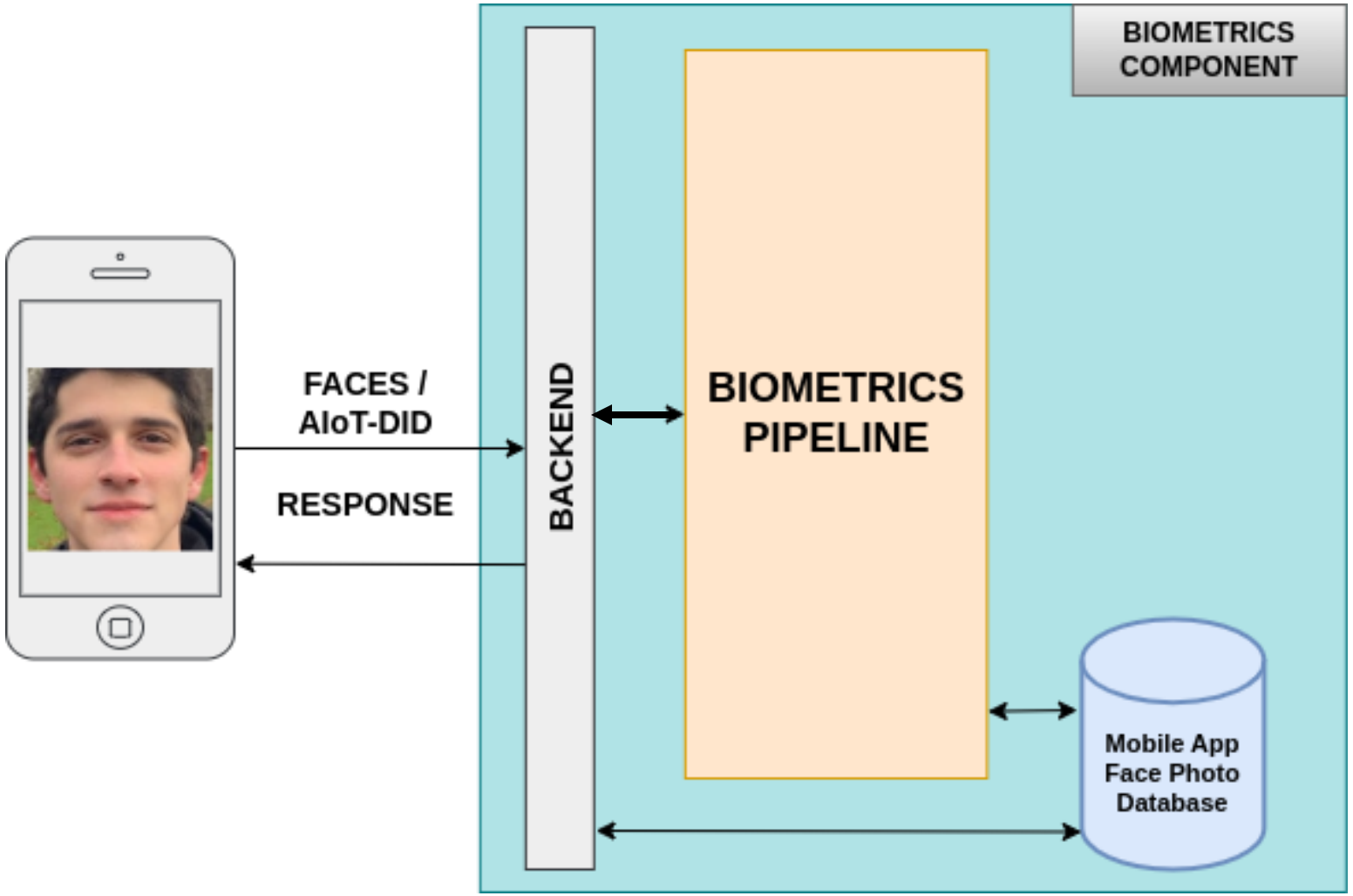
1. User needs to be registered in the system. For example, via an APP that takes a selfie and send it to the Biometrics Component to be stored in the DB.
2. User needs to be authenticated to access the APP. The APP will take a selfie and send it to Biometrics Component that will compare it with the one stored and decide if both faces belong to the same person.
3. User can request a service so an UAV will go to their position and verify its face (ARCADIAN). This can also be done on CCTV cameras, for example in access control use cases.
4. In the APP the user could also update its image or delete the profile

REGISTER

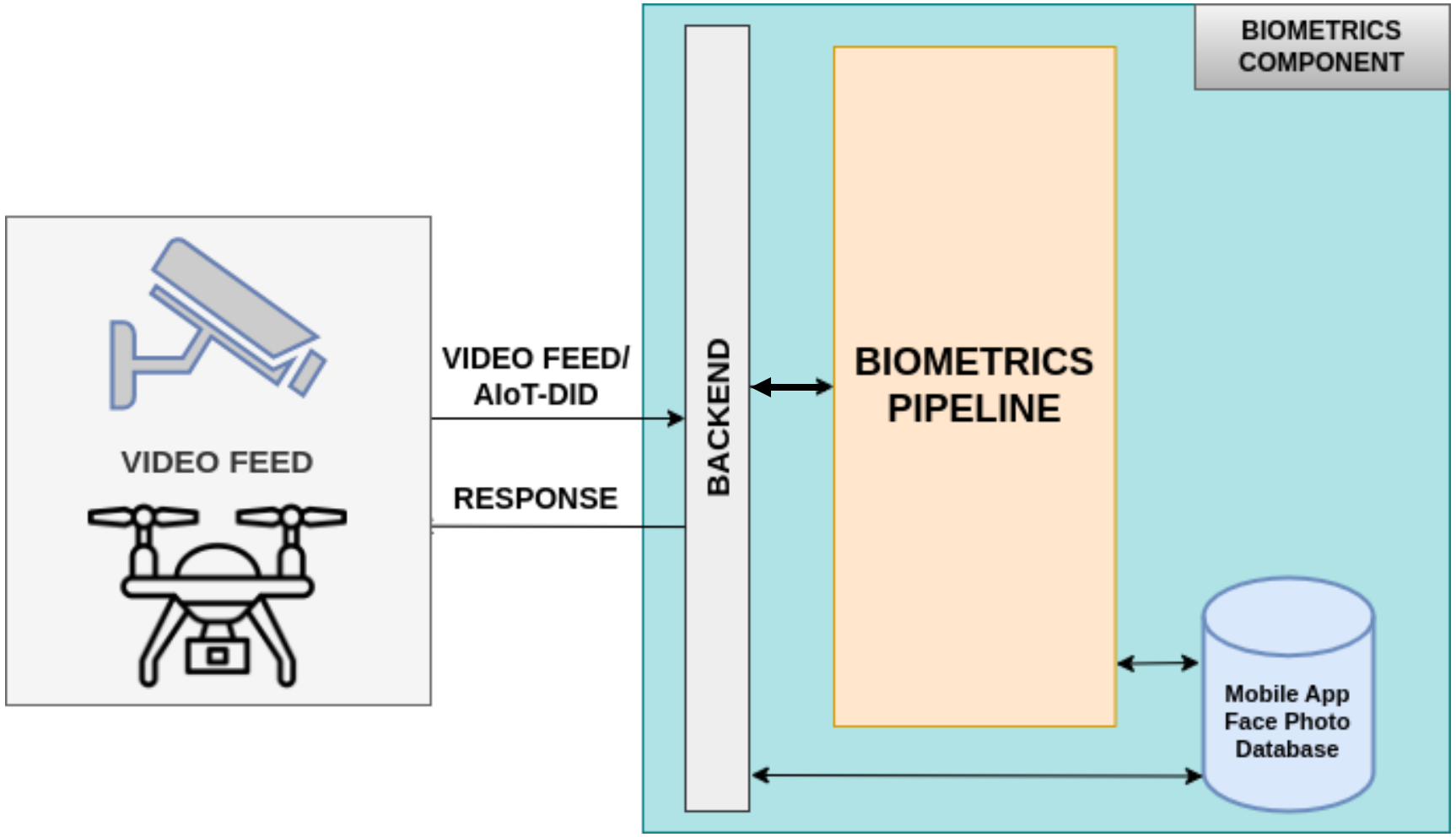
ARCADIAN-IoT



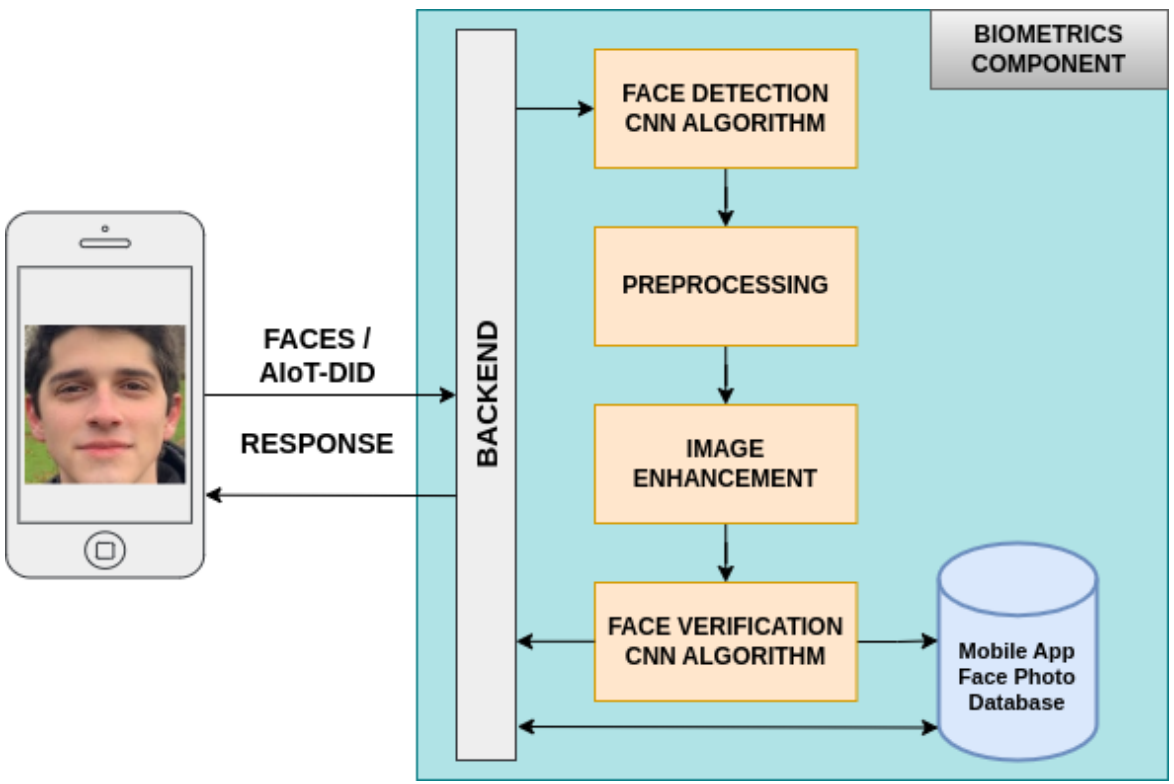
AUTHENTICATION

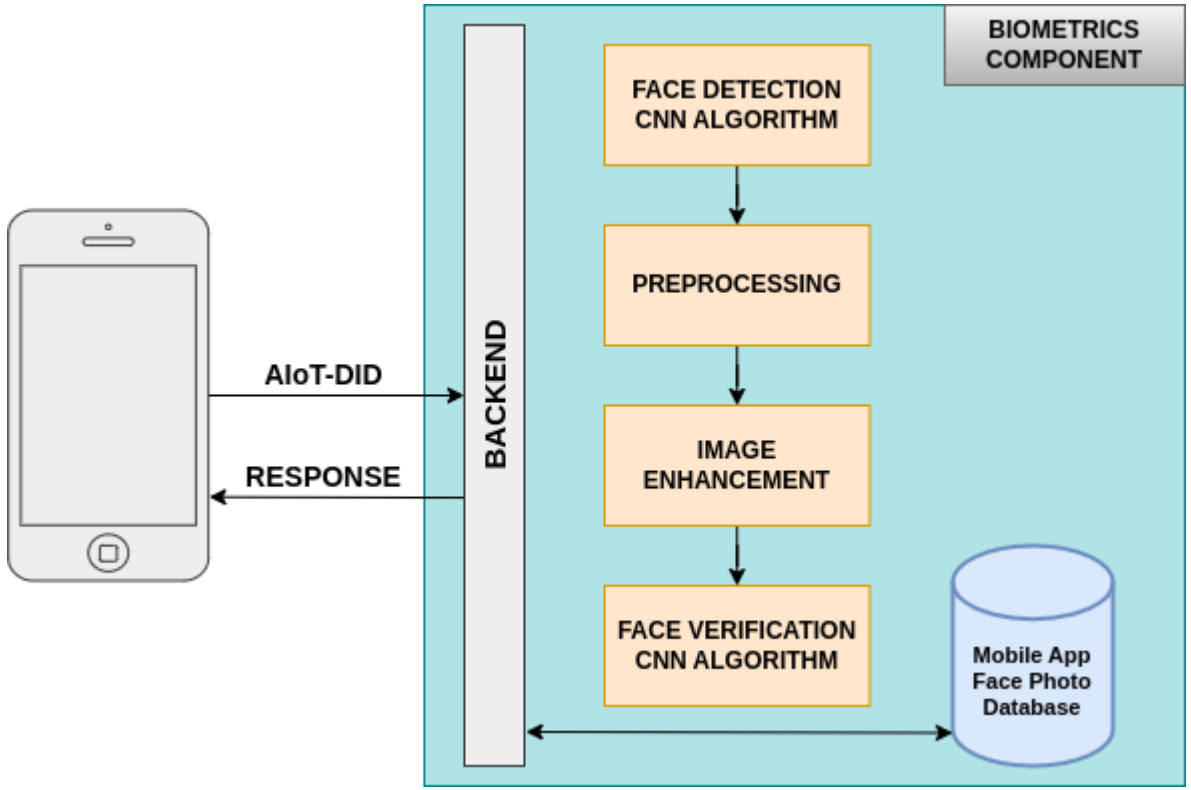


SERVICE REQUEST



UPDATE AND DELETE





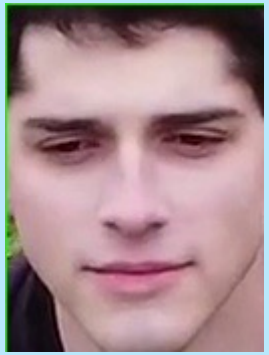
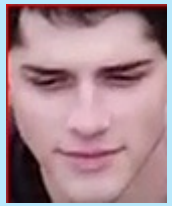
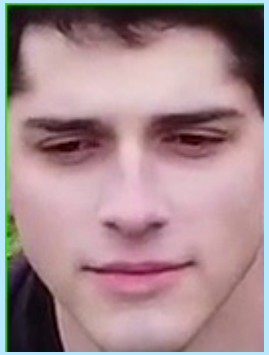
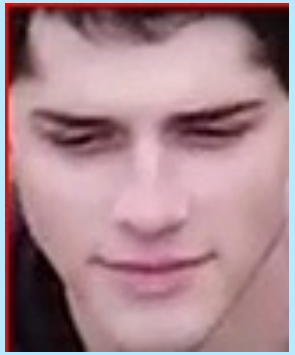
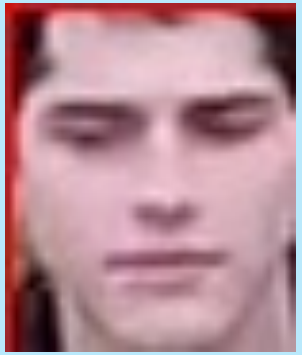
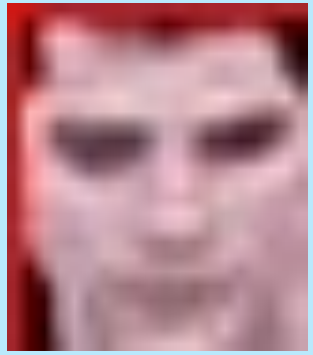
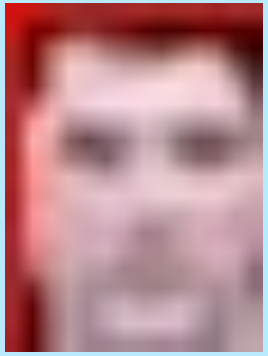
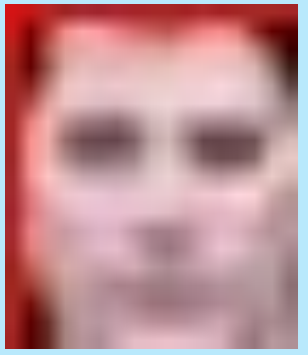
BIOMETRICS CHALLENGES

BIOMETRICS CHALLENGES

- ✓ Long distances (Up to 20 meters) - Low pixel faces
- ✓ Movement of the people
- ✓ Movement of the drone
- ✓ Recording angle – Camera usually higher than the person (CCTV or Drones)
- ✓ Different lighting conditions
- ✓ High inference speed required – Fast changing conditions

DISTANCE CHALLENGES

ARCADIAN-IoT

2 meters	5 meters	7 meters	10 meters	15 meters	20 meters	25 meters	30 meters
							
							

ARE THEY THE SAME PERSON?

ARCADIAN-IoT

NO!!!

ARE THEY THE SAME PERSON?

ARCADIAN-IoT

YES!!!

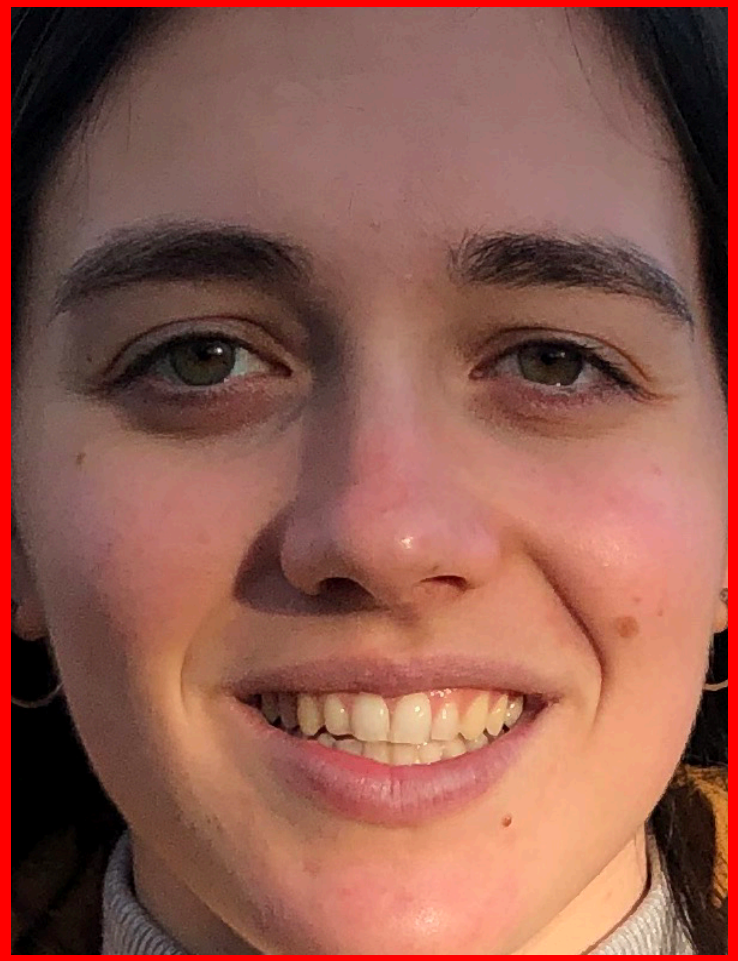
ARE THEY THE SAME PERSON?

ARCADIAN-IoT

YES!!!

ARE THEY THE SAME PERSON?

ARCADIAN-IoT



NO!!!

ARE THEY THE SAME PERSON?

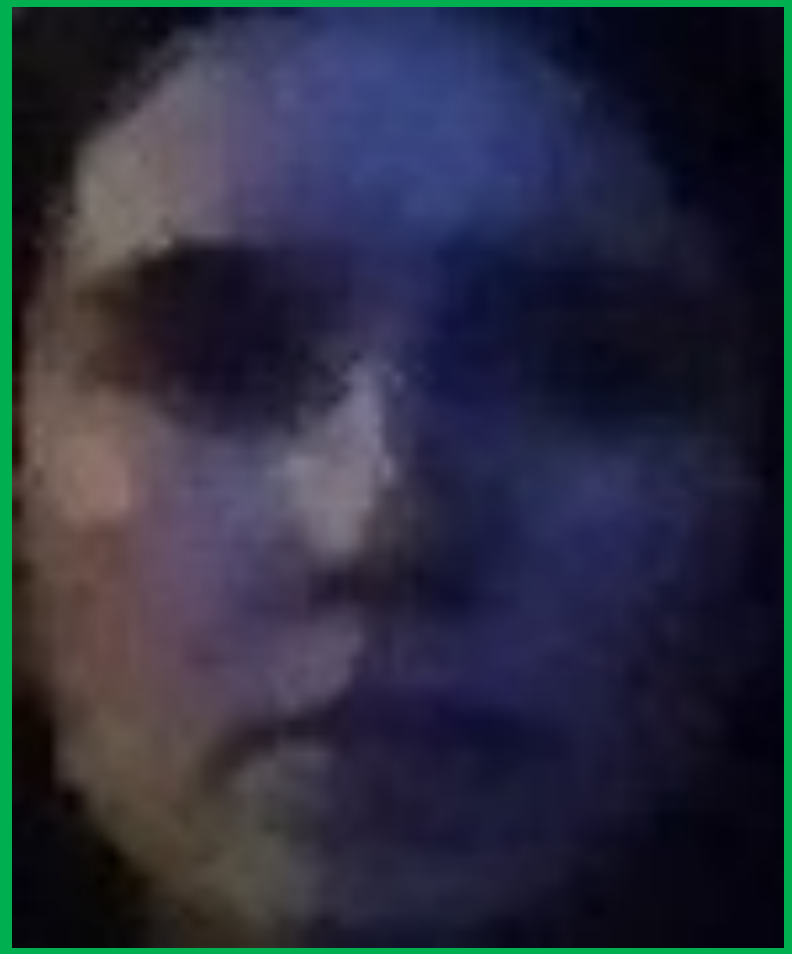
ARCADIAN-IoT

NO!!!

ARE THEY THE SAME PERSON?

ARCADIAN-IoT

YES!!!



WHAT CAN BIOMETRICS ACHIEVE?

WHAT CAN BIOMETRICS ACHIEVE?

ARCADIAN-IoT

- FAR (False Acceptance Rate): Probability that the system will have a false positive.
- Accuracy: The sum of true positives and true negatives divided by the total number of faces. Percentage of correct results in the system.
- FAR and accuracy are related. Lower the FAR lower the accuracy.

WHAT CAN BIOMETRICS ACHIEVE?

ARCADIAN-IoT

Distances	Accuracy	FAR
< 2m	91.65 %	0.5 %
> 2m	71.81 %	0.46 %

	Time (ms)	Frames per second
Face verification algorithm	56 ms	18 FPS
End-to-end	143 ms	7 FPS

LEGAL CONSIDERATIONS

LEGAL CONSIDERATIONS

ARCADIAN-IoT

- Only data processed is video and images from people' faces.
- No names, contact details or personal data are stored, managed or shared by Biometrics.
- During registration, user accepts "Privacy Policy" and takes five images of their face from different positions.
- These images are sent to biometrics component, where they are processed and stored in an encrypted non-readable format.

LEGAL CONSIDERATIONS

ARCADIAN-IoT

- All data is stored in a private system and will not be shared with third parties.
- The images in the registration are kept until the user requests them to be deleted or after 5 years of its collection.
- The video or images for authentication are never stored. They are kept for less than 2 seconds in a volatile memory.

LEGAL CONSIDERATIONS - MEASURES

ARCADIAN-IoT

- Data encryption: Images stored in a non-readable way.
- Data anonymisation: No link between the name of the user and its image.
- Data minimisation: The minimum data of the user is requested: no contact details, name…
- The image will be linked to that user using a DID.
- All based and following the EU and UK GDPR (General Data Protection Regulation)

CONCLUSIONS

CONCLUSIONS

ARCADIAN-IoT

- Biometrics is used in ARCADIAN for face verification from drones.
- But it can also be used for face recognition or video feeds from other cameras such as CCTVs.
- It can be used for numerous use cases: intruder detection, access control…
- For close or long face verification or recognition.
- It can be varied depending on the needs of the use case:
  - If speed is not a requirement, a higher recognition accuracy can be achieved.
  - A lower FAR can also be achieved depending on the level of security of the use case.

THE CONSORTIUM

ARCADIAN-IoT

Click to add text

ARCADIAN-IoT

THANK YOU FOR YOUR ATTENTION

arcadian-iot.eu

ARCADIAN-IoT project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 101020259

THIS PROJECT IS PART OF THE NEXT GENERATION IoT

www.ngiot.eu