Automated Onboarding Passenger Kiosk

Problem Definition/Statement

One of the most important things to do before a flight's take off is the onboarding of its registered passengers. It is imperative to make sure that the allowed passengers are the same ones that booked the flight and that they are not carrying any contraband. This process can be very tedious and time consuming not to talk of error prone if executed by human security personnel.

The aim of this project is to build an automated onboarding passenger kiosk that uses Azure cognitive services to validate the intended passenger using computer vision (face authentication, text extraction, object detection) solutions.

Objectives

- Validate the identity of the passenger using the recorded video from the kiosk, the passengers ID card, and the boarding pass.
- Validate the flight using the information on the passenger's boarding pass.
- Extract the emotion and sentiment of the passenger's experience with the automated kiosk.
- Detect contraband in the passenger's luggage (Using lighter images in this case)

Data sources and resulting dataset

- Front facing Camera:
    - 30 seconds video of the passenger:
        - Face pictures of the passenger – [Identity Validation]
        - Sentiment and emotion of the passenger – [Kiosk Experience]
- Image Scanner:
    - Boarding pass:
        - First Name – [Identity Validation]
        - Last Name – [Identity Validation]
        - Seat – [Flight Validation]
        - Date – [Flight Validation]
        - Flight No. – [Flight Validation]
        - Origin – [Flight Validation]
        - Destination – [Flight Validation]
    - Driver's license ID:
        - First Name – [Identity Verification]
        - Last Name – [Identity Verification]
        - Date of Birth – [Identity Verification]
        - Face – [Identity Verification]
        - Sex – [Identity Verification]
    - Passenger's Luggage:
        - Lighter images – [Carry-on Baggage Validation]

Solution Strategy

- The passenger will submit their driver's license and their boarding pass to the kiosk's image scanner from which their face data and other validation data will be taken for identity verification and flight validation.
    - ❖ **Form recognizer**: Text data extraction from the **Boarding Pass** and the **Driver's ID**.
    - ❖ **Face API**: Face extraction from the **Driver's ID**.
- A 30 seconds video of the passenger will be recorded during this time using a front facing camera on the Kiosk also for passenger verification.
    - ❖ **Video Analyzer**: face extraction from video frames.
- A luggage scanner connected to the kiosk that makes use of an object detection algorithm will be used to check for any contraband in the luggage of the passenger.
    - ❖ **Custom Vision**: carry out object detection using lighter images.

Model metrics and evaluation

- **Custom object detection model**:
    - ❖ Recall, Precision: These metrics will be used to evaluate the object detection model used in detecting contraband (lighter images) in the passenger's luggage.
        - Precision: A minimum precision of **70%** must be achieved before the model will be considered okay for use.
        - Recall: A minimum recall of **70%** must also be achieved by the detection model
- Confidence scores: The confidence scores of the model in verifying the passengers face (Face API) and also matching the passengers' details (Form recognizer) will be used to evaluate the performance in the validation process.
    - ❖ Form recognizer:
        - **The prebuilt ID form recognizer model** will be evaluated using a minimum threshold confidence score of **70%** in detecting the texts from the ID cards.
        - **The custom boarding pass form recognizer model** must attain a minimum confidence score of **65%** in recognizing the texts.
    - ❖ Face recognition model:
        - **The face recognition model** must attain a minimum threshold of **60%** before the passenger's face will be considered approved for boarding the flight.