**Automatic Passenger Boarding Kiosk Writeup**

**Problem Definition**

Nowadays, using air travel for commute has become one of the most used modes of transportation worldwide. However, while catching flights in an airport, the boarding process performed by the airline staff is observed to be the most time taking one. It is the last small step before one enters the plane, still makes one believe otherwise. Flyers tend to book flights at odd times to find lesser crowd at the airport or even spend money on priority check-ins during buying the ticket. This causes frustration and irritation to most of the travelers. Hence, a way to fasten this manual boarding process can be highly effectual for improving the customer experience. It would save lot of flyer’s time and lead to customer satisfaction. Towards this, an automated passenger boarding kiosk, a computer vision solution is suggested. It will verify passenger’s identity, flight information and carry-on luggage sans human assistance.

**Solution Strategy**

A computerized boarding kiosk is suggested as the solution for the given problem statement. Before digging into the solution, various technical considerations including the use of cloud technology, image classification, object detection, text extraction technology, data persistence, security, scalability and auditing local government rules need to be taken care of. Additionally, since the data is stored on the Azure cloud, the policies around it need to be understood and adhered upon. Also, during the entire lifetime of the product, one needs to monitor whether the product follows the regulations set for Responsible AI or not, so that it brings a reliable and accountable solution for the passengers.

With that said, the following is the solution walkthrough with the details of corresponding Azure-based products to be used for achieving the major steps of the proposed solution.

* The automatic passenger boarding kiosk has a front facing camera, an image scanner as well as a bag scanner.
* When the flyer comes to the boarding kiosk, he/she is asked to the show the ID card to the image scanner. The prebuilt ID recognizer model of the **Azure Form Recognizer** resource will extract text out of the ID. Also, the **Azure Face API** will detect the face on this ID.
* Then, he/she is prompted to stand still in front of the front facing camera for 30 seconds and it will start taking the video of the user. This video is analyzed by the **Azure Video Analyzer** to extract the face and get insight on emotions and sentiment of the user.
* Later, the user is asked to show the Boarding pass of the flight he/she is about to board to get flight details and match it with the passenger manifest records. The custom boarding pass form recognizer model of the **Azure Form Recognizer** resource will extract text out of the boarding pass.
* Finally, the carry in baggage has to kept into the bag scanner attached to the kiosk to check if lighter is present in it. This check is performed by using a lighter detection model built using **Azure Custom Vision** service.
* All the photos and models are stored in **Azure Blob storage** hosted on the Azure cloud for easy access by the services.
* After 4 validations as mentioned below, a green signal to boarding is given by the kiosk. Otherwise, if any of the validations fail, the passenger is disallowed to board and would be checked by a flight attendant to verify all documents of the passenger.

The **validations** that need to be performed are as follows:

* Identity Validation – Verify the image of the passenger extracted from the video and ID card are same(PersonValidation). Furthermore, the First name and last name should match the same details on the ID card(NameValidation). Also, the DoB and Sex mentioned on the ID should match the manifest(DoBValidation).
* Flight Validation – Verify Seat No, Date, Origin, Destination and Date mentioned on the boarding pass is same as the one mentioned in the manifest against that passenger (BoardingPassValidation).
* Boarding Kiosk Experience – The emotion and sentiment of the passenger extracted from the user must be recorded for customer experience analysis.
* Carry-on baggage Validation – Through object detection, one needs to see if a lighter is detected or not in the image of carry-on baggage for each passenger(LuggageValidation).

To conclude the **4 major data sources** would be a video of the passenger captured using front facing camera, a digital identity proof and boarding pass of the to-be boarded flight which is collected by the image scanner at the boarding gate, and finally an image scan of the carry-on bag.

In terms of **evaluation metrics**, I have referred to recall/ precision scores given by the Azure models. For thresholds, the identification of faces should have a higher than 60% score to saw that the person in the video is same as the person in the id card. Furthermore, for lighter detection, the test images should have a higher than 70% accuracy of detection in more than 50% (3 out of 5) of the test images to consider the model a good model to predict the presence of lighters in the image.