



FORENSIC EXAMINATION OF BOARDING PASSES: DISTINGUISHING BETWEEN GENUINENESS AND FORGERY - A CASE STUDY

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Abstract: Apart from ticket to an air plane, another crucial document that is required to ensure air travel is Boarding Pass. Being issued during the course of check-in process, this document is extremely crucial to ensure entry in the security areas of airport and to board the airplane. It contains unique and specific data of the passenger and security features embedded in it to establish its authenticity. Although, the airline authorities employ strict measures to detect and to prevent use of fake boarding passes, still there have been increasing incidences of producing fake boarding pass and other fraudulent activities involving the manipulation and forgery of genuine ones, posing significant security challenges to the Aviation sector and Homeland Security. The manipulations in the boarding passes varying from a simple alteration in the important information on boarding passes to sophisticated forgeries are done by the fraudsters to fulfil their spiteful intention. This paper presents a case study that delves into the forensic examination of Disputed boarding pass to ascertain its genuineness or detect manipulations by following a comprehensive approach combining traditional forensic analysis with advanced technological methods. The need to enhance the detection and prevention of fake/forged boarding pass is also highlighted in the paper to bolster the safety of passenger and the integrity of insure air travel.

Key Words: Boarding Pass, Check-in process, Security Features, Fake Boarding Pass, Forensic Analysis, Homeland Security.

Highlights

- Forensic investigation of disputed boarding pass to determine its authenticity or to identify manipulations if present.
- Utilization of traditional forensic techniques and advanced technological tools.
- Various security features in boarding pass are foregrounded.
- Adds to the limited forensic literature on examination of boarding pass.
- Offers an analytical framework which can be replicated for future forensic examination.

I. Introduction

A boarding pass is a crucial document for air travel. It is issued during the course of check-in process to the passenger and grants permission to access the secured areas of the airport as well as to board the airplane of the specific flight. It contains various key information to identify the passenger and the flight to be boarded

such as passenger's name, date of departure and time of departure, flight number, gate number, etc. as highlighted in the image of boarding pass in Figure 1.

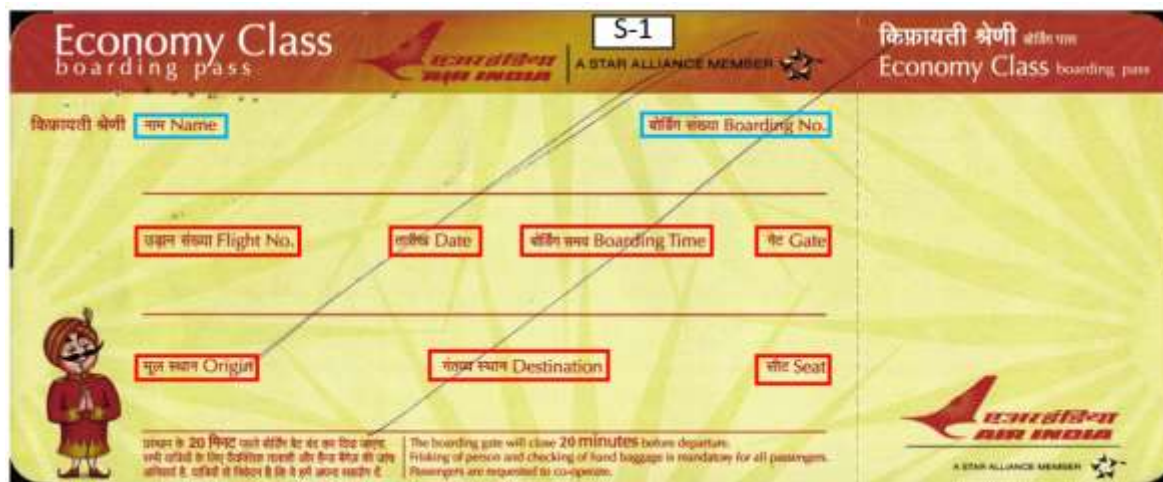


Figure 1. Boarding Pass containing Passenger details highlighted with blue markings and Flight details highlighted with red markings.

There are various ways of issuing boarding pass and therefore there are different types of boarding pass such as Physical Boarding Pass and Digital Boarding Pass. The passengers can print their boarding passes themselves by self-service kiosk or can visit the check-in counter where the flight officials will issue the paper boarding pass. However, with the technological advancements and for the comfort of the passengers and staff, digital boarding passes have been facilitated including paperless boarding passes (via App), mobile (electronic) boarding pass, etc. Digital Boarding Pass can be generated and shown on a mobile device.

In summary, Boarding passes can be physical (paper) or digital (mobile), and they come in different types depending on the traveller's needs, preferences, and the services provided by the airline. Each type serves the same primary function: to grant passengers access to their flight. A boarding pass is needed to verify traveller's eligibility to travel, guide the traveller through airport procedures, and help ensure safety, order, and efficiency during traveller's flight. It's an essential document for air travel, without which the traveller wouldn't be able to board the flight.

Various security features are implemented in boarding passes by the airlines and airport authorities to verify the authenticity of boarding pass such as printing paper i.e. thermal paper, Boarding pass scanners, barcode/QR code, unique identifiers, advanced passenger details. These features combined with the vigilant checks by the airport and their staff, help ensure that the issued boarding passes are being used by their rightful owners and may reduce the risk of fraud, identity theft and other criminal activities, still there are increasing incidence of fraudulent activities involving the manipulation and forgery of boarding passes poses significant security challenges within the aviation sector.

The fraudsters do manipulations in boarding passes varying from simple alterations in important information on the boarding pass to sophisticated forgeries to fulfil their malicious intents, deceiving the airline and security personnels as well as law enforcement agencies. Some common manipulations that are found in boarding passes:

1. Changes in Passenger's name.
2. Modification in flight details such as date of departure, time of departure, flight number or destination.
3. Creating a fake boarding pass by trying to replicate the visual appearance and some security features using various graphic design software.
4. Duplication and cloning, which involves scanning and printing of a legitimate and genuine boarding pass as well as duplicating its digital version to be used by another individual.
5. Tampering in Barcode or QR Code, which is done to change the details of passenger or information of flight by altering the information encoded in them.
6. Addition of fake security features to a forged or manipulated boarding pass such as watermarks, holograms, or some other security features so as to make it visualize more authentic.

7. Digital Manipulation which involves alterations in the digital boarding passes by using various sophisticated editing software and then printing this altered version or displaying it on a mobile device.

Although, the individual airlines and Indian authorities, including the Bureau of Civil Aviation Security (BCAS), employ strict measures in detection and prevention of the creation and use of forged or fake boarding passes, yet the incidents of their creation and misuse are increasing day by day.

This case study delves into presenting one such case of Disputed boarding passes and its forensic examination in comparison with the specimen boarding pass in order to ascertain their genuineness or to identify forgery, if done any. The case study presents a comprehensive approach to study and examine the various elements and security features of the boarding passes combining traditional forensic analysis with advanced technological methods including the scientific tools and instruments available in the laboratory. The case study also discusses the various implications that such fraudulent activities impose on airport security as well as aviation industry and other law enforcement agencies. The study further highlights the necessity to enhance the detection as well as prevention of fake or forged boarding passes strengthen the passenger safety and integrity of a secured air travel.

II. Case History

An intriguing case which involved Disputed Boarding passes alleged to be fake or forged were submitted for the Forensic Examination to determine its authenticity. This case reveals that how a simple document can be manipulated and can be used to bypass the tight security systems, leading to a serious consequence. The Disputed Boarding passes were collected from the suspects in a crime who produced them as an alibi to the investigating agency claiming that the suspects were present at some another place at the time of the incidence and not at the crime scene. This posed a significant challenge to investigation agency as well as to the aviation sector as a boarding pass is a crucial document which is subjected to be issued to the passenger only by the concerned airline authorities. Therefore, the claim made by the suspect raised a grave concern. Hence, the investigating agency submitted the Disputed Boarding passes along with a Specimen Boarding Pass for forensic examination to verify its authenticity and, by extension, the suspect's claims.

The role of forensic experts in such cases is crucial as they conduct the necessary forensic examination to provide objective evidence that can confirm or refute the suspect's claims about their whereabouts at the time of the crime. Further, it is also crucial from the view of detecting the authenticity of these disputed boarding passes or otherwise as altering such a document or creating fake boarding passes are fraudulent activities which are subject to legal penalties as well.

Forensic document examination of boarding pass has its own challenges and limitations as the security features are very minute to be detected and require precise observation. The forensic experts thoroughly and meticulously examined the Disputed Boarding passes in comparison with the Specimen Boarding Pass and observed all the minute details and various security features using several techniques along with other scientific tools and equipment which enabled detection and verification of its authenticity.

III. Forensic Examination and Observations

The forensic documents examination initiates with the stamping and marking of the documents wherein the Disputed Boarding passes were stamped and marked as D-1 and D-2 whereas the Specimen Boarding Pass was stamped and marked as S-1. The following observations were made during the forensic examination of both the sets of Disputed and Specimen boarding passes utilizing the scientific tools and equipment available at the laboratory.

1. Dimensions: On examining the Specimen and Disputed boarding passes, the dimensions of Disputed boarding passes marked as D-1 and D-2 were found to be different than that of Specimen boarding pass marked as S-1.

2. Paper Quality: Often high-quality thermal papers are used to print the Boarding passes at the airport. These papers are used to maintain the print quality and are sensitive to heat and light. They are primarily used because the prints taken on them remain resistant to moisture, fading and smudging making them suitable to be handled in diverse environments, which makes it difficult to alter the information printed on

them without causing any visible damage to the paper. The Specimen Boarding Pass marked as S-1 had high quality thermal paper whereas the Disputed boarding passes marked as D-1 and D-2 had poor quality paper.



Figure 2. Disputed Boarding passes marked as D-1 and D-2 to be compared with Specimen Boarding Pass marked as S-1.

3. Microscopic Analysis: The microscopic examination revealed fine details otherwise not visible to the unaided eyes such as differences in the printing of the Disputed and Specimen boarding passes indicating that different printing techniques were used in their creation. On scientific examination, it was observed that the Specimen Boarding Pass marked as S-1 had a high-quality printing which was indicated from the clear and crisp images and texts whereas the Disputed Boarding passes marked as D-1 and D-2 revealed poor printing quality which was indicated by the unclear images, smudged ink, misalignment of texts and blurred edges of texts.



Figure 3(a). Differences observed in printed areas as shown in the background surface between D-1 and D-2 in comparison to S-1.

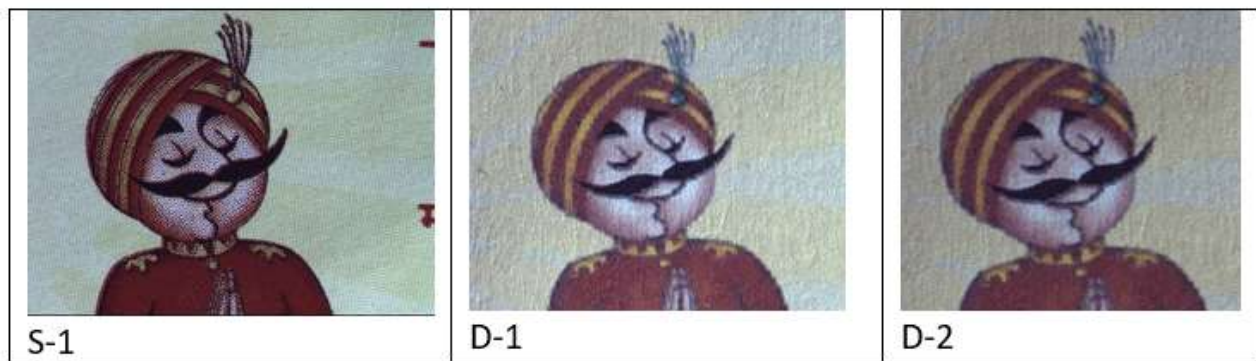


Figure 3(b). Differences observed in printed areas as shown in the face of Maharaja, mascot of Air India between D-1 and D-2 in comparison to S-1.

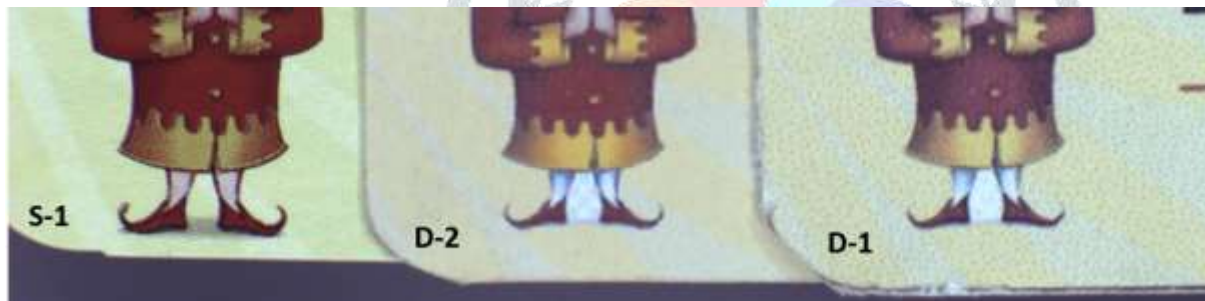


Figure 3(c). Differences observed in printed areas as shown in the bottom areas of Maharaja, mascot of Air India between D-1 and D-2 in comparison to S-1.

4. Perforations: The perforation line is present in the boarding pass for the ease of tearing, which allows the airlines or airport staff to separate the portion which is retained by the airline and rest part is returned to the passenger. The nature of perforation line of the Disputed Boarding passes marked as D-1 and D-2 were found to be different than that of Specimen Boarding Pass marked as S-1 as shown in the Figure 4.

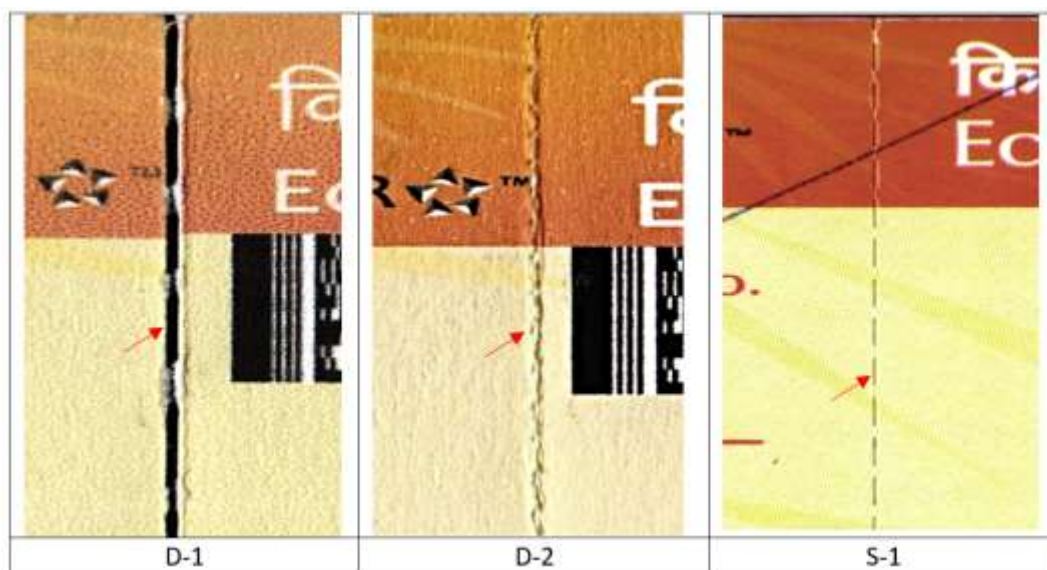


Figure 4. Differences observed in nature of perforation line between D-1 and D-2 in comparison to S-1.

5. Design/Logo Analysis: The Disputed and Specimen boarding passes belonged to Air India airlines. As such the genuine boarding pass of Air India airlines contains peculiar design and logo which are “Maharaja”, mascot of Air India and the lettering of “A Star Alliance Member” with circular emblem under the main logo of AIR INDIA. Various differences were found in the designs and logo present on the Specimen and Disputed boarding passes including their colour and fine details. The stark differences found are mentioned below:

- a. The design of “Maharaja”, mascot of Air India on the left side at the bottom as shown in Figure 5(a)
- b. The lettering of “A Star Alliance Member” with circular emblem under the main logo of “AIR INDIA” located at the top and on the right side at the bottom as shown in Figure 5(b) and Figure 5(c).
- c. Design in the background surface as shown in Figure 5(d).

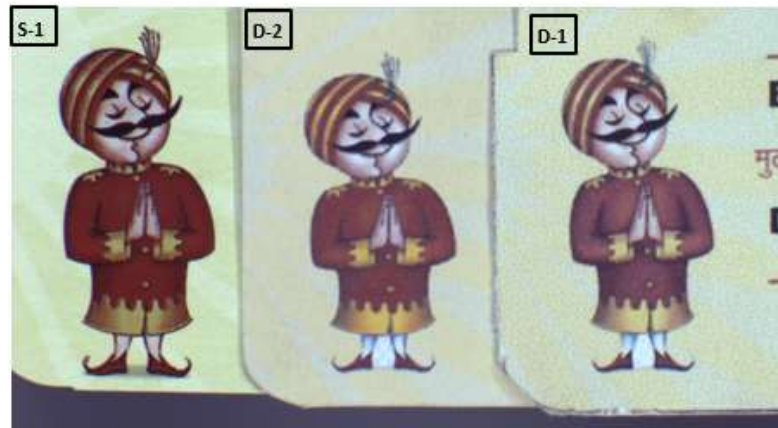


Figure 5(a). Differences observed in design between D-1 and D-2 in comparison to S-1 as shown in the Maharaja, mascot of Air India.



Figure 5(b). Differences observed in design between D-1 and D-2 in comparison to S-1 as shown in the logo of “Air India”.

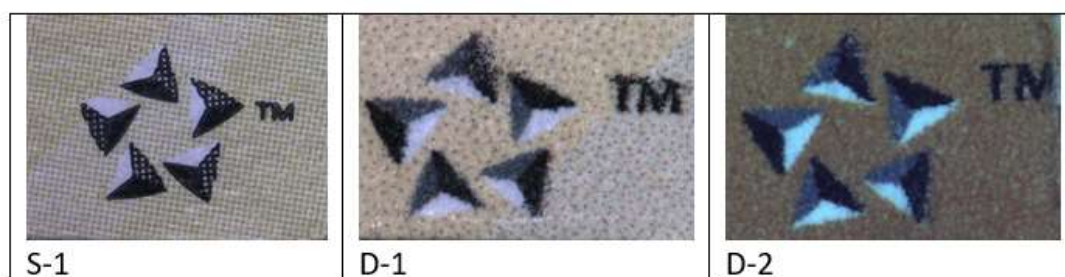


Figure 5(c). Differences observed in design between D-1 and D-2 in comparison to S-1 as shown in the circular emblem of logo of “A Star Alliance Member”.

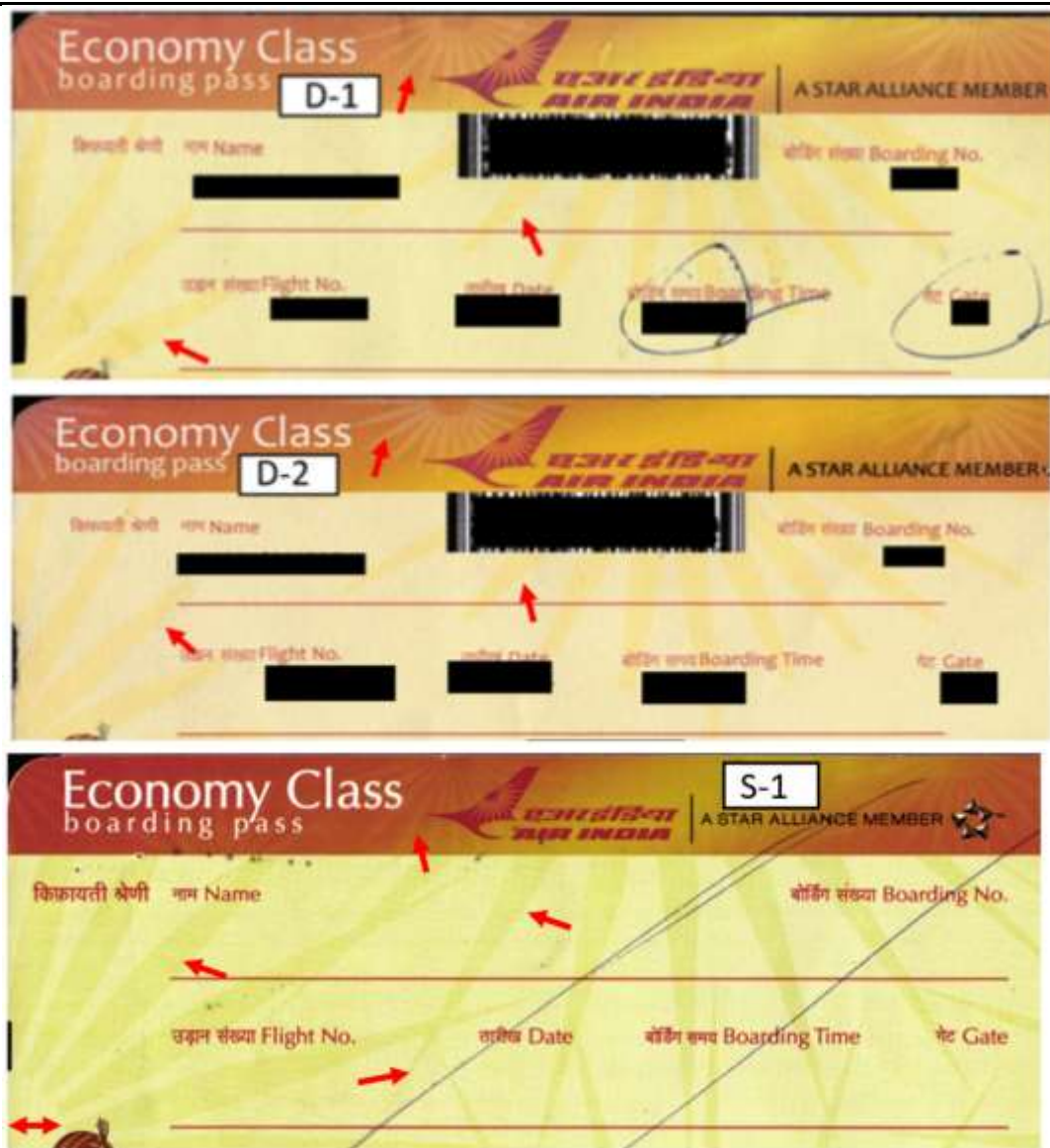


Figure 5(d). Differences observed in design between D-1 and D-2 in comparison to S-1 as shown in the background areas.

6. Font and Text Examination: The font style and size were found to be different between the Specimen Boarding Pass marked as S-1 and the Disputed Boarding passes marked as D-1 and D-2 as shown in the figures given below. Differences were also observed in placement of letters and vowel signs in words present in the printed text such as 'बोर्डिंग', 'मूल', 'वैयक्तिक', 'किफ़ायती', 'हमें', 'यात्रियों' between the Specimen Boarding Pass marked as S-1 and the Disputed Boarding passes marked as D-1 and D-2.

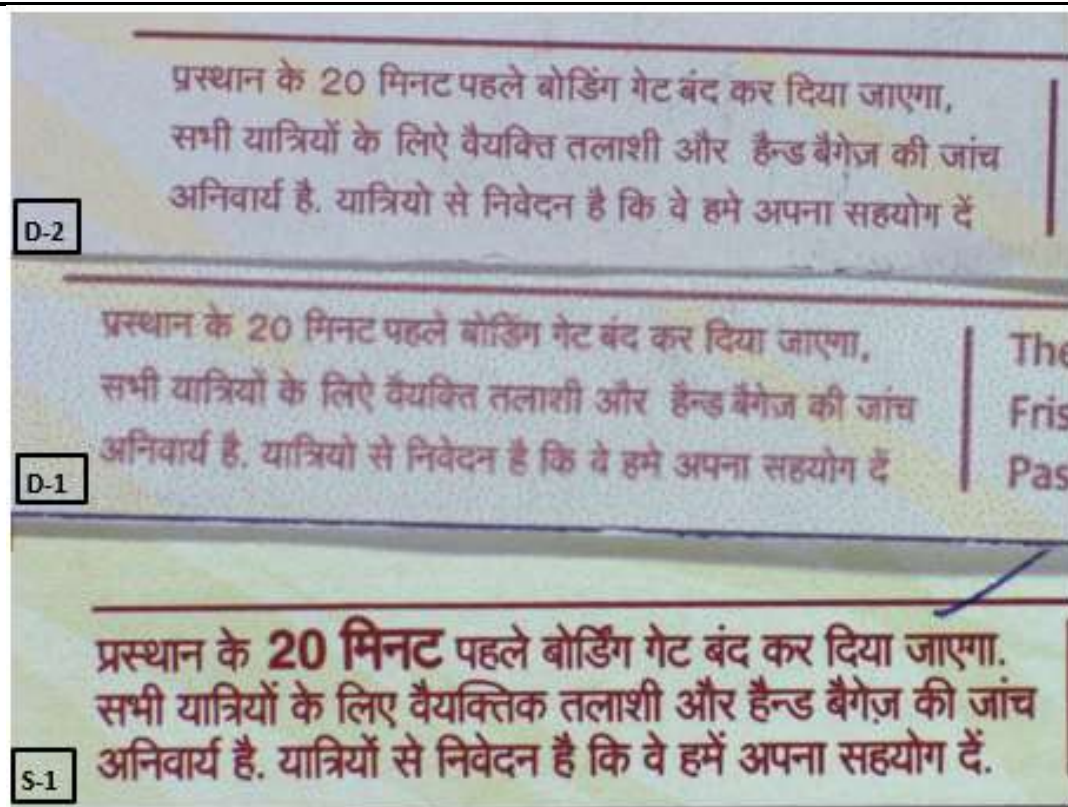


Figure 6(a). Differences observed in font size and style as well as placement of letters and vowel signs between D-1 and D-2 in comparison to S-1 as shown here in words such as 'बोर्डिंग', 'मूल', 'वैयक्तिक', 'हमें', 'यात्रियों'.

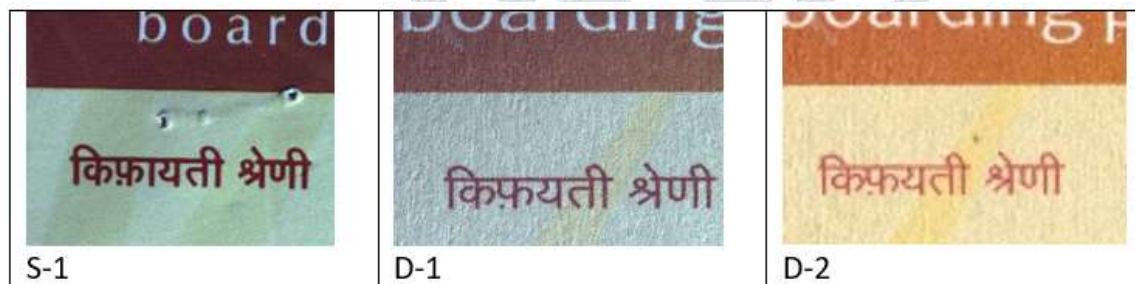
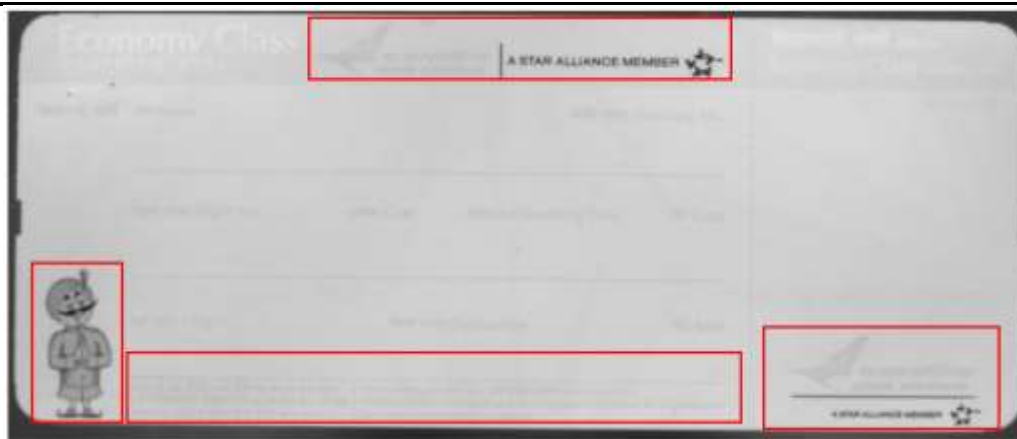


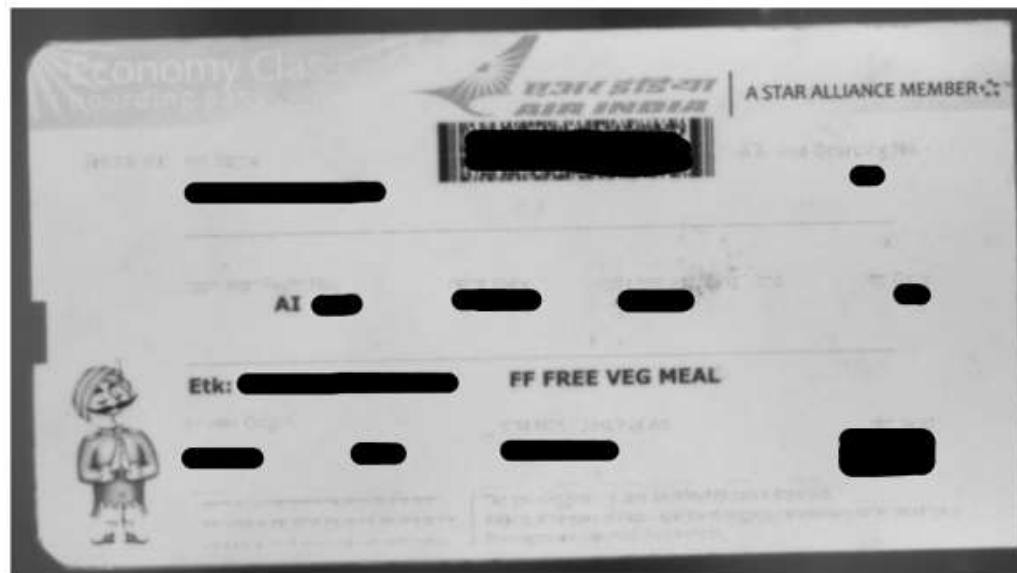
Figure 6(b). Differences observed in font size and style as well as placement of letters and vowel signs between D-1 and D-2 in comparison to S-1 as shown in the word 'किफ़ायती'.

7. **Examination under Infra-Red (IR) Light Source:** The differences were observed between the Specimen Boarding Pass marked as S-1 and the Disputed Boarding passes marked as D-1 and D-2 under Infra-red light source which are as mentioned below and shown in the Figure 7:

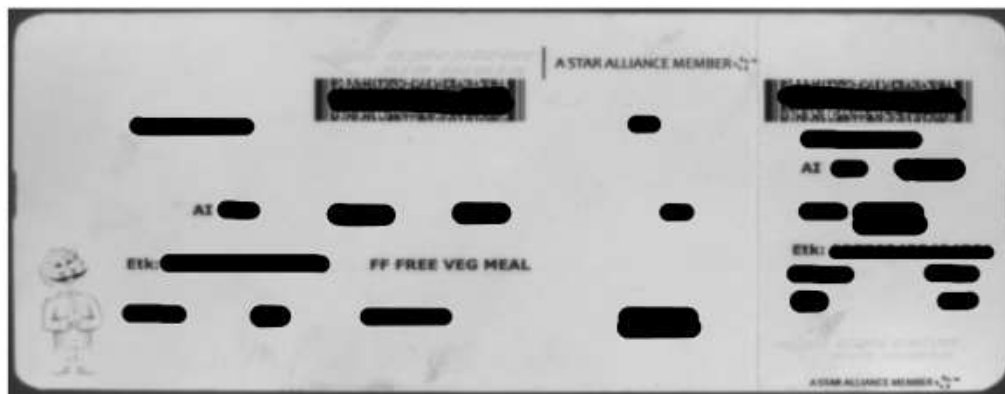
- a. The image of Maharaja, mascot of Air India on the left side at the bottom.
- b. The logo of AIR INDIA at the top and on the right side at the bottom.
- c. The star logo of Star Alliance at the top and on the right side at the bottom.
- d. The area containing the printed text in English and Hindi font at the bottom of the boarding pass.



S-1



D-1

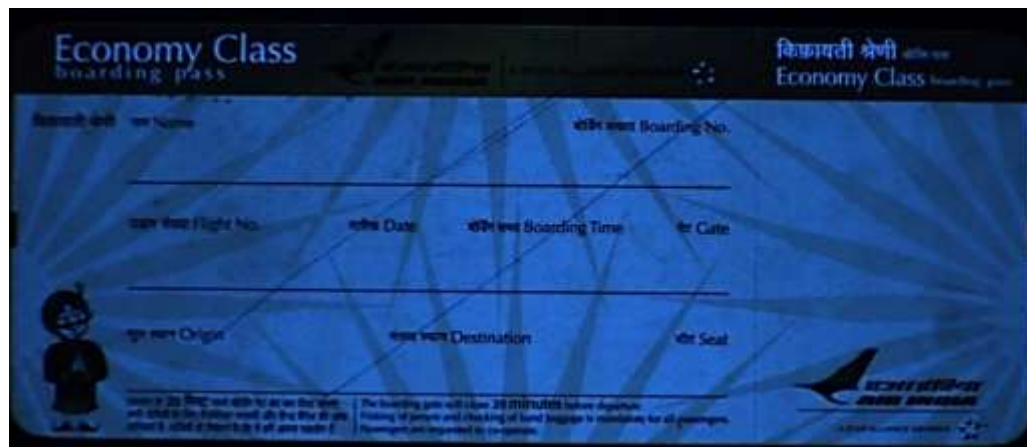


D-2

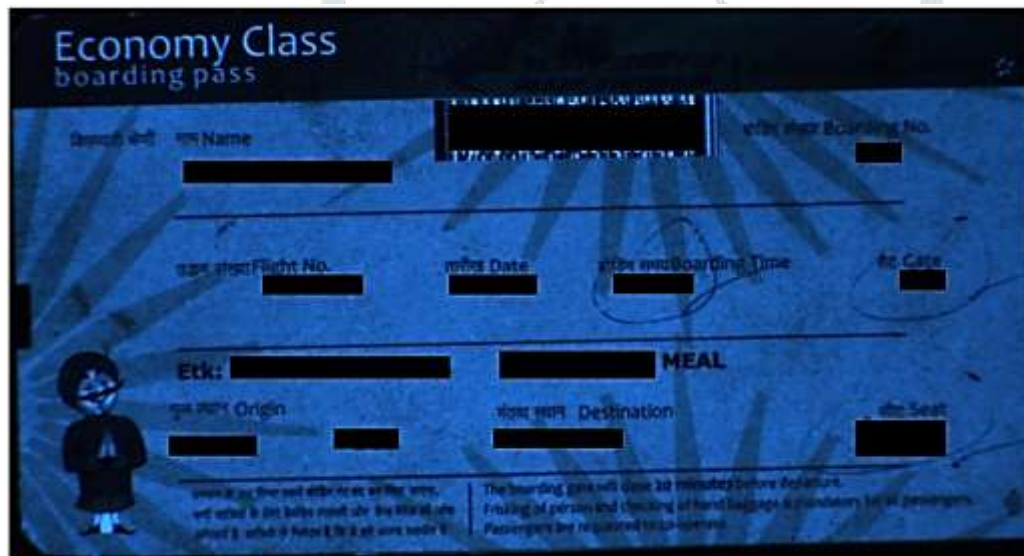
Figure 7. Differences observed under Infra-red (IR) examination at 780 nm between D-1 and D-2 in comparison to S-1 as shown here.

8. Examination under Ultra-violet (UV) Light Source: The differences were observed between the Specimen Boarding Pass marked as S-1 and the Disputed Boarding passes marked as D-1 and D-2 under Ultra-violet light source which are as mentioned below and shown in the Figure 8(a) and Figure 8(b).

- a. The image of Maharaja, mascot of Air India on the left side at the bottom.
- b. The logo of Star Alliance Member at the top and on the right side at the bottom.
- c. The stark differences in the design in the background surface can also be visualized.



S-1

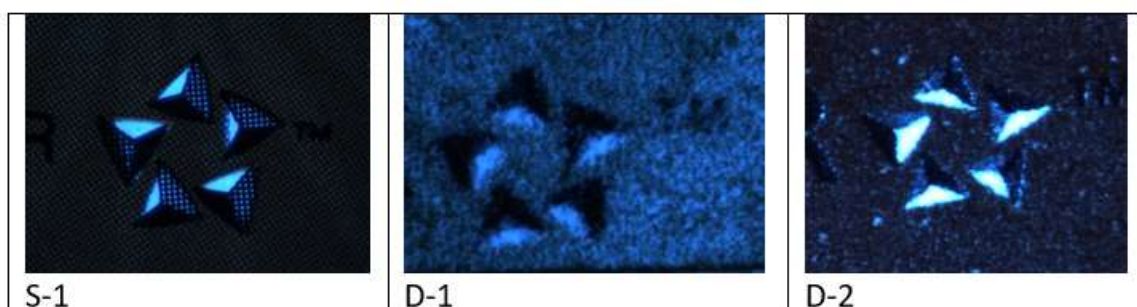


D-1



D-2

Figure 8(a). Differences observed under Ultra-violet (UV) examination at 365 nm between D-1 and D-2 in comparison to S-1 as shown here.



S-1

D-1

D-2

Figure 8(b). Differences observed under Ultra-violet (UV) examination at 365 nm between D-1 and D-2 in comparison to S-1 as shown here in the logo of Star Alliance Member.

Despite several challenges which were faced by the forensic experts during examination, an effortless attempt was made to examine the documents with the help of scientific tools and techniques. This structured approach ensures that the forensic examination of a boarding pass was conducted methodically, allowing forensic experts to uncover any manipulations or fraud effectively. The ultimate goal is to provide concrete evidence that can be used in legal proceedings or to improve security measures.

IV. Conclusion

From all the forensic examination done thoroughly by utilizing scientific tools and equipment, it was unravelled that the Disputed boarding passes marked as D-1 and D-2 were fake. They were found to be different in comparison with Specimen Boarding pass in their physical features such as paper quality, dimensions and perforations; microscopic features including fine details in printing quality and techniques as well as unveiling the signs of scanning and further difference in design and logo. Also, D-1 and D-2 were found to be different from S-1 in their font style and size as well as in the placement of letters and vowel signs in words printed in the text. They were also found to be different in context to various security features on being examined under the IR and UV light sources. All of these findings indicated that the Disputed boarding passes marked D-1 and D-2 were fake and generated from a different source utilizing different printing technique.

V. Discussion

Creating fake boarding passes or alteration of the genuine ones are fraudulent activities which are rising day by day and they are a menace to the aviation industry as well as to the homeland security. They are misused for impersonation and identity theft to fulfil various malicious intents including travel with a false identity, bypassing security measures and to gain unauthorized access to secure and restricted areas, smuggling and trafficking. Further, they are fraudulently created or altered to access airport lounges or as used in this case by the suspect to create false alibi. Hence, posing a significant security risks and a challenge to the airport authorities. They are also a threat to the law enforcement agencies and therefore should be curbed.

Understanding the importance of this crucial document, it is cardinal to check the security features of boarding pass thoroughly to ensure its authenticity. Identification of genuine, fake or alterations in boarding pass demands attention to detail and thorough knowledge of security features of the boarding pass. This paper describes the crucial security features of a boarding pass and their examination to determine its authenticity or otherwise. The author has explained all the security features observed during the forensic examination in a detailed manner which unveiled the fake boarding pass and assisted the investigating agency in further investigation.

Ensuring the genuineness of a boarding pass is pertinent so that only legitimate passengers access flights as well as airport services and also it will help the investigating agencies in cases like the one mentioned in this case study. This may include the use of advanced technology to verify the authenticity of all the documents at the time of boarding to spot the potential forgeries by the training staff, and further implementation of legal penalties for those who are being caught while using or creating fake boarding passes. This case not only underscores the risks which are associated with the fraudulent boarding passes but also triggers the significant changes in the security protocols of global aviation.

VI. Acknowledgement

The authors are thankful to Director, CFSL, DFSS, Pune, HOD and scientific staff of Documents Division, CFSL, DFSS, Pune for their valuable support and co-operation in carrying out the research work.

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