

Chapter 7

Designing for Boundary Detection of Foreign Objects in Airports Using Python 3

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ABSTRACT

Boundary detection of foreign objects in airports is a critical safety concern, as debris and other objects can cause significant damage to aircraft and pose a serious risk to passenger safety. This chapter explores the use of Python programming language and computer vision techniques for the detection of objects at airports. The study presents an overview of the detection of objects in airport problems and their significance in aviation safety, followed by a detailed description of the Python-based foreign object detection system architecture. The system incorporates image processing algorithms and deep learning models to identify and classify foreign objects on airport runways and other operational areas. The chapter discusses the advantages and limitations of using Python for detection and highlights the potential for future research in this area. The study concludes by emphasizing the importance of detection in ensuring safe and efficient airport operations and the potential benefits of boundary detection using Python version 3.

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INTRODUCTION

This paper enables individuals to effortlessly recognize and distinguish objects within an image, a task that the human visual system is capable of performing with speed and precision. The human visual system can also execute intricate undertakings such as identifying multiple objects and detecting obstacles with minimal conscious effort. In this project, we will work on object detection, and optimize the same with the help of modern convolutional techniques. Foreign object detection in airports is a security measure that involves using specialized equipment to scan for and locate any objects that do not belong in a designated area, such as an airport. The goal of foreign object detection is to ensure the safety and security of passengers and personnel by identifying and removing any potential threats before they can cause harm. There are several different types of equipment that can be used for foreign object detection, including x-ray machines, metal detectors, and bomb-sniffing dogs. These measures are typically implemented in high-traffic areas such as security checkpoints and boarding gates. In object detection, a boundary box, also known as a bounding box, is a graphical representation of the location and size of an object in an image or video. It is typically represented as a rectangular box drawn around the object, with the dimensions of the box indicating the size of the object and the position of the box indicating the location of the object within the image or video. Boundary boxes are commonly used in computer vision tasks such as object recognition, tracking, and classification. Traditional Boundary detection methods involve manual inspections by airport staff, which can be time-consuming and error-prone. To address this challenge, several automated Boundary detection systems have been developed using computer vision techniques and machine learning algorithms. In recent years, Python has emerged as a popular programming language for developing Boundary detection systems due to its ease of use, flexibility, and extensive library support. Python-based Boundary detection systems can process live video feeds from airport cameras and identify any foreign objects present in the footage. Python also provides a range of machine learning libraries, including TensorFlow, Keras, and PyTorch, which can be used to develop deep learning models for Boundary detection. This paper presents a Python-based Boundary detection system that utilizes deep learning techniques for object detection and classification. The system also includes a user-friendly interface that allows airport staff to monitor Boundary detections in real time and take appropriate action to remove any foreign objects. It also aims to demonstrate the feasibility and effectiveness of using Python and deep learning techniques for Boundary detection in airports. The proposed system can significantly improve airport safety and efficiency by reducing the risk of aircraft damage and downtime caused by foreign objects. The paper also serves as a valuable contribution to the field of aviation safety and provides a framework for future research in this area.

LITERATURE REVIEW

Wang et al. (2022) describes the concept of a “trainable bag-of-freebies” and how it contributes to YOLOv7’s success. The authors also discuss the technical details of YOLOv7 and compare its performance to other object detectors. This extension reduces the number of identities switches and allows objects to be tracked through longer periods of occlusion. The implementation runs in real-time and is computationally efficient. The paper provides details on the methodology, experimental results, and code availability for further research experimentation and practical application development. In Muayer et al. (2018), the use of artificial intelligence to find foreign object debris (FOD) on airport runways is covered

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