Chapter 5
Developing Industry 4.0 Smart Parking Through Deep Learning and IoT-Based for Electric Vehicle

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ABSTRACT

Object detection is central to computer vision, drawing significant attention lately. Deep learning techniques shine for their precision, robustness, and speed. Their integration into Industry 4.0 is widely recognized, especially in AI-powered smart parking systems. This fusion is swiftly advancing, bolstering Industry 4.0 smart parking management and security. This chapter introduces a comprehensive framework presenting both software and hardware components, along with a mixing methodology, to enhance industry smart parking through detecting electric vehicles. The foundation of this approach lies in the application of deep learning, specifically utilizing the YOLOv3 methodology. In addition, the internet of things (IoT) is leveraged, employing a Raspberry Pi4 platform. The methodology for the development and execution of the system is outlined step by step to provide a clear understanding. This integrated solution showcases the detailed practical implementation. As a result, the detection of two vehicles has achieved confidence scores exceeding 0.7.

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INTRODUCTION

The fusion of deep learning with Internet of Things (IOT) technologies has become crucial in the quickly developing field of smart buildings (Jan & Ahsan, 2021). While object detection focuses on locating and identifying certain objects within visual data, deep learning, a subset of artificial intelligence, has proven to be a game-changer in managing complex data (Pal et al., 2021; Sharma & Naaz, 2020). In the context of the smart industry, this technological synergy improves automation, security, and overall efficiency.

Deep learning and the IOT have been the focus of many researchers (Lakshmanna et al., 2022). (Babangida et al., 2022) focus on a review of implementation strategies for activity recognition by looking at various sensor's technologies. These technologies were used to gather useful data from IOT devices, reviewing preprocessing and feature extraction techniques. In addition, classification algorithms are used to identify human activities in smart homes. Finally, the study hypothesizes that combining IOT sensor data with a variety of activity labels depending on time might help reduce computational overhead and enhance activity detection. (Sujith et al., 2022) gave a thorough analysis of smart health monitoring, recent developments, and ongoing difficulties. Deep learning and machine learning have been used to evaluate health data to achieve a number of goals, including managing patient mortality and providing preventative healthcare. This has made it feasible to diagnose chronic illnesses early on, which was previously impossible. to improve the efficiency and responsiveness of the services at the hospital and at home. Additionally, cloud computing and cloud storage have been combined. (Franco et al., 2021) presented an invasive load monitoring solution based on IoT architecture for power monitoring and activity detection in smart homes. A machine learning based appliance recognition system first identifies the appliances. This is examined using three alternative models: a support vector machine classifier, a long short-term memory neural network, and a simple feed-forward neural network. Comparisons are made between the three models' accuracy, precision, recall, and F1-score. The most effective model is then applied. To offer a Deep-learning-based framework for intelligent energy management, (Han et al., 2021) concentrated on the needs of today's smart households, industries, and grids. We offer an effective channel of communication between energy distributors and consumers, as well as short-term predictions of future energy use. They used several preprocessing strategies to handle the variety of electrical data before implementing an effective decision-making algorithm for short-term forecasting on devices with limited resources. A new security architecture and an attack detection method that effectively detects devices are presented by (Kumar Sahu et al., 2021). The suggested approach extracts the precise feature representation of the data using a convolution neural network, and then further categorizes it using a long-term memory model. Twenty Raspberry Pi-based IoT devices that were infected provided the dataset for the experimental evaluation. In a Face Detection Dataset, which has 9205 photos of samples wearing masks and three categories, (Jiang et al., 2021) suggested the face detection method. In addition, they suggested Squeeze and Excitation (SE)-YOLOv3, a mask detector with balanced efficacy and efficiency. To gain the linkages between channels and incorporate the attention mechanism, also a block into Darknet 53 was introduced. This allowed the network to concentrate more on the key feature. Yet, a little amount of research has been done on object recognition in smart homes using deep learning to enforce energy control.

To achieve this, this research chapter proposes a comprehensive framework aimed at improving industry 4.0 smart parking with a focus on detecting electric vehicles. The proposed system integrates