A Cloud-Integrated IOT-Based Anti-Theft System for Home Using Image Processing

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Abstract

Home security has become a major concern due to the rise in burglary and unauthorized access incidents. This study proposes a cloud-integrated IoT-based anti-theft system using real-time facial recognition to enhance security measures. Traditional security systems often lack real-time detection and remote monitoring capabilities, leading to inefficiencies in preventing security breaches. To address this, we designed a system that integrates Raspberry Pi, a webcam, and a smartphone application built on the Blynk platform , with Firebase cloud services for real-time data processing and storage. The Convolutional Neural Network (CNN) was chosen over other lightweight machine learning algorithms such as KNN, SVM, and Gradient Boosted Classifier, because it provides higher accuracy and better adaptability to variations in lighting, face angles, and distances, while remaining computationally efficient for Raspberry Pi hardware . The research methodology involves hardware setup, software implementation, and testing in various real-world scenarios. Experimental results show that CNN outperforms other machine learning algorithms, with evaluation using confusion matrices confirming higher accuracy and lower false detection rates, especially in well-lit environments. The system successfully alerts homeowners through instant notifications upon detecting unrecognized individuals. This research advances knowledge by demonstrating how AI and IoT integration can achieve real-time, affordable, and efficient security solutions suitable for embedded systems, thereby contributing to the academic and engineering body of knowledge. Privacy and ethical considerations are acknowledged, with facial data handled securely to ensure compliance with data protection principles. The findings also highlight limitations, as performance decreases in low-light conditions, which can be addressed in future work by integrating infrared or low-light cameras to enhance detection accuracy . This study serves as a foundation for further developments in smart security systems, ensuring a safer living environment through intelligent technological advancements.

Keywords: Cloud Integration, Facial Recognition, Image Processing, IoT, Security System