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TensorFlow, Computer Vision, and Edge AI-based Face Recognition Attendance Monitoring System Using Raspberry Pi 5

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***Abstract*—Attendance is taken as a important aspect in learning process but manual methods are slow. This paper describes the design, implementation, and assessment of an edge-based face recognition based attendance using a Raspberry Pi 5 (8 GB RAM) with the help of LogiTech 720p USB Camera and TFT HDMI Display for dashboard. On-device face detection, extraction, and recognition are achieved by means of models (MobileNetV2, FaceNet- both of which we tuned to achieve the best performance for our system) which is constructed with TensorFlow Lite. We present extensive literature review of RFID, biometric, QR, cloud-based and edge-based approaches along their detailed system design, model optimization, deployment issues and privacy and ethical considerations. Experiments show that the proposed approach achieves high matching accuracy in most conditions and can also resist privacy leakage, and is practical on devices with moderate power and low cost.**

***Index Terms*—Edge AI, Raspberry Pi 5, Face Recognition, Attendance Monitoring, TensorFlow Lite, Computer Vision, IoT, Privacy**

I. Introduction

A. Motivation and Context

Attendance tracking is a fundamental administrative task in schools, promoting discipline, participation, and proper record-keeping. Nevertheless, conventional practices like manual roll calls or sign-in sheets are ineffective and prone to errors. These processes take 5–10 minutes per class, translating to several hours for a semester and cutting down on precious instructional time. In addition, manual processes are susceptible to proxy attendance, misreporting, and poor integration with computerized academic systems.

The growing trend towards online education has strengthened the requirement for automated attendance systems that enhance operational effectiveness and data integrity with reduced human intervention. Automation can facilitate real-time analytics, effortless integration into learning-management systems, and enhanced student engagement monitoring. Developing such systems involves juggling several trade-offs — precision, expense, scalability, and anonymity — while ensuring user trust and institutional conformity.

B. Paper Vision: Vision at the Edge

This paper presents *Vision at the Edge*, a face recognition attendance system designed to be both privacy-conscious and cost-effective, running entirely on a Raspberry Pi 5. Unlike