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Android Application for Medicine Expiry Date Detection

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Abstract*: The improper management of medicine expiry dates poses a significant risk to public health, healthcare costs, and patient safety, particularly in developing countries where manual stock monitoring is still prevalent. Expired medicines can lead to reduced therapeutic effectiveness, adverse drug reactions, and economic losses due to wastage. With the rapid growth of mobile computing, computer vision, and artificial intelligence (AI), automated medicine expiry date detection systems have emerged as a promising solution to address these challenges. This review paper critically examines existing research and technologies related to medicine expiry date detection, including image processing, optical character recognition (OCR), mobile health (mHealth) applications, and inventory management systems. The paper identifies key gaps in current approaches, such as limited accuracy under real-world conditions, lack of offline functionality, and poor integration with healthcare workflows. Based on the reviewed literature, the paper highlights design considerations and future research directions for developing an intelligent, accessible, and reliable medicine expiry date detection application suitable for low-resource environments.*

Keywords—Medicine Expiry Detection, Computer Vision, Optical Character Recognition, Mobile Health, Inventory Management, Artificial Intelligence

1.0 Introduction

Medicines play a critical role in disease prevention, treatment, and overall public health. Ensuring that medicines are safe and effective throughout their lifecycle is a core responsibility of healthcare systems. One of the major challenges in pharmaceutical management is the monitoring of medicine expiry dates, particularly in hospitals, pharmacies, and households where large quantities of medicines are stored [1]. The use of expired medicines can reduce therapeutic effectiveness and may cause serious health complications [2].

Traditionally, expiry date monitoring has relied on manual inspection and record-keeping, which is time-consuming, error-prone, and inefficient, especially in settings with limited human resources [3]. The advancement of mobile technologies, artificial intelligence, and computer vision has opened new opportunities for automating this process. Mobile applications equipped with cameras and OCR techniques can automatically detect expiry dates from medicine packages and provide alerts before medicines expire [4].

This review paper focuses on the design and implementation concepts of a medicine expiry date detection application. It synthesizes existing literature to understand current solutions, identify gaps, and outline key considerations for developing an effective system that enhances patient safety and reduces medicine wastage.

1.1 Project Background

The global pharmaceutical industry produces vast quantities of medicines annually, many of which are discarded due to expiration before use. The **World Health Organization (WHO)** reports that poor inventory management contributes significantly to medicine shortages and wastage, particularly in low- and middle-income countries [5]. In healthcare facilities, expired medicines not only result in financial losses but also pose serious risks if mistakenly dispensed to patients [6].

The integration of Information and Communication Technologies (ICT) into healthcare, commonly referred to as eHealth and mHealth, has transformed how medical services are delivered and managed [7]. Mobile applications have been widely adopted for health monitoring, appointment scheduling, and medication reminders. More recently, researchers have explored the use of computer vision and OCR to automatically extract textual information, such as drug names and expiry dates, from medicine labels [8].

Optical Character Recognition, combined with image preprocessing techniques, enables systems to recognize printed expiry dates even under varying lighting conditions and package designs [9]. Additionally, machine learning models have been shown to improve recognition accuracy by learning from diverse datasets of medicine packaging [10]. Despite these advances, many existing systems are limited to controlled environments and require continuous internet connectivity, which restricts their usability in resource-constrained settings [11].

The proposed medicine expiry date detection application builds on these technological foundations, aiming to provide an intelligent, user-friendly, and offline-capable solution that supports pharmacists, healthcare workers, and individual users.

1.2 Problem Statement

Despite the availability of digital technologies, the management of medicine expiry dates remains largely manual

in many healthcare facilities and households. This situation leads to several critical problems. First, manual checking of expiry dates is prone to human error, increasing the likelihood of expired medicines being used or dispensed [12]. Second, healthcare institutions experience significant financial losses due to poor tracking and late identification of soon-to-expire medicines [13]. Third, existing digital inventory systems often require manual data entry, which is time-consuming and not feasible in busy or under-resourced environments [14].

Although some mobile applications provide medication reminders, they typically depend on users manually entering expiry dates, limiting their effectiveness and adoption [15]. Furthermore, many OCR-based solutions struggle with low-quality images, diverse packaging formats, and inconsistent date representations [16]. There is therefore a clear need for an automated, accurate, and accessible medicine expiry date detection application that minimizes human intervention while functioning reliably in real-world conditions.

2.0 Related Works

This section reviews existing literature relevant to medicine expiry date detection, focusing on inventory management systems, OCR-based solutions, and mobile health applications.

2.1 Medicine Inventory Management Systems

Early digital solutions for medicine management focused on inventory control systems used in hospitals and pharmacies. These systems track stock levels and expiry dates through database records entered manually by staff [17]. While effective in structured environments, such systems are highly dependent on accurate data entry and regular updates, which are often lacking in practice [18].

2.2 Optical Character Recognition in Healthcare

OCR technology has been widely applied in healthcare for digitizing medical records, prescription analysis, and label recognition. Studies by Smith et al. demonstrate that OCR can successfully extract textual information from medicine labels with high accuracy under controlled conditions [9]. However, real-world challenges such as curved surfaces, reflective packaging, and varied fonts significantly reduce performance [19]. Recent research has incorporated deep learning-based OCR models, which show improved robustness and adaptability [10].

2.3 Mobile Health Applications for Medication Safety

Mobile health applications have been developed to support medication adherence and safety. Applications that provide alerts for medication schedules and expiry reminders have shown positive impacts on user compliance [20]. Nevertheless, most of these applications rely on manual input of medicine details, limiting scalability and increasing the risk of incorrect data [21].

2.4 Image Processing and Computer Vision Approaches

Computer vision techniques, such as image preprocessing, edge detection, and text localization, play a crucial role in improving OCR accuracy. Research by Patel et al. highlights that combining image enhancement with machine learning classifiers significantly improves expiry date detection accuracy [22]. Despite these advances, integration into lightweight mobile applications with offline capability remains an open research challenge [23].

3.0 Observations and Research Gaps

From the reviewed literature, several gaps are evident. First, many systems address medicine management or OCR in isolation, without integrating them into a unified, user-friendly application. Second, limited attention has been given to offline functionality, which is critical in regions with unreliable internet connectivity. Third, there is insufficient evaluation of these systems in real-world healthcare settings, particularly in developing countries [11], [24]. Addressing these gaps is essential for the successful deployment of medicine expiry date detection applications.

4.0 CONCLUSION

This review paper has examined existing research related to the design and implementation of medicine expiry date detection applications. While significant progress has been made in OCR, computer vision, and mobile health technologies, their application to automated expiry date detection remains limited by practical constraints such as accuracy, usability, and connectivity. An integrated, AI-driven, and offline-capable solution has the potential to significantly improve medication safety, reduce wastage, and support healthcare systems.

Future research should focus on robust model training, system integration, and real-world validation to ensure effective adoption. This review analyzed existing research on expiry date detection systems and their applicability to medicine packaging. While numerous OCR and deep learning approaches have been proposed, most are not tailored to pharmaceutical products. The lack of integrated mobile systems for medicine expiry detection and management remains a significant limitation.

A dedicated medicine expiry date detection application leveraging modern computer vision techniques can bridge this gap. Such a system would enhance medication safety, reduce health risks, and improve medicine management practices for individuals and healthcare providers alike.

Recommendations and Future Work

Future work has focused on:

- Developing medicine-specific datasets for expiry date recognition
- Integrating advanced text detection models such as YOLO
- Supporting offline recognition for low-connectivity areas

- Implementing inventory tracking and alert notifications
- Conducting real-world usability evaluations

In future work, we will implement and evaluate a mobile application that integrates these features.

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