Application of Computer Vision to Automatic Prescription Verification in Pharmaceutical Mail Order

A.T. Alouani
Department of ECE
Tennessee Technological University
Box 5004
Cookeville, TN38505
aalouani@tntech.edu

Abstract
In large volume pharmaceutical mail order, before shipping out prescriptions, licensed pharmacists ensure that the drug in the bottle matches the information provided in the patient prescription. Typically, the pharmacist has about 2 sec to complete the prescription verification process of one prescription. Performing about 1800 prescription verification per hour is tedious and can generate human errors as a result of visual and brain fatigue. Available automatic drug verification systems are limited to a single pill at a time. This is not suitable for large volume pharmaceutical mail order, where a prescription can have as many as 60 pills and where thousands of prescriptions are filled every day. In an attempt to reduce human fatigue, cost, and limit human error, the automatic prescription verification system (APVS) was invented to meet the need of large scale pharmaceutical mail order. This paper deals with the design and implementation of the first prototype online automatic prescription verification machine to perform the same task currently done by a pharmacist. The emphasis here is on the visual aspects of the machine. The system has been successfully tested on 43,000 prescriptions.

I. Introduction
The 1998 mail order pharmaceutical sales reached $11.2 Billions [1]. For large scale mail order operations, prescriptions may be automatically filled. To ensure that the appropriate drug goes to the appropriate patient before shipping, pharmacists perform the prescription verification task. Bottles containing patient drug travel down a conveyor belt while the pharmacist visually checks each bottle to see if it contains the correct drug based on patient information on a bar code on the pill bottle label. The pharmacist has approximately two seconds to verify each prescription. At a rate of 2 seconds per prescription, a pharmacist will have to perform 1800 verifications per hour. To reduce the human fatigue, different pharmacists are employed at different shifts of the mail order operation. Beside the economical burden, the verification task is still tiring which can lead to errors in the verification process.

Available automatic pill verification systems are limited to a single pill at a time [2]-[5]. This is not suitable for large volume mail order, where a prescription can have as many as 60 pills, see Figure 1, and where thousands of prescriptions are filled every day. To reduce human fatigue, cost, and limit human error, the automatic prescription verification system (APVS) was invented. The visual information processing aspect of the APVS is the emphasis of this paper.

This paper is organized as follows. Section 2 contains the conceptual design of the APVS machine. Section 3 discusses the information processing and decision making aspects of the machine. Section 4 discusses the color based decision making of the APVS. Section 5 presents the results of the field test covering 43,000 prescriptions. Section 6 contains conclusions and discussions.

II. The APVS Conceptual Design
The main concept of the APVS was motivated by an understanding of how the pharmacist performs prescription verification. The pharmacist grabs a bottle from the conveyor, looks at it and compares its visual content to a