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Yang

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(54) **DETECTION AND DETERRENCE OF COUNTERFEITING OF DOCUMENTS WITH TOKENS CHARACTERISTIC COLOR AND SPACING**

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(58) **Field of Search** **399/366, 17, 45; 382/135, 137, 165; 358/1.9**

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,039,066	A	*	8/1977	Quigley	399/45
4,881,268	A	*	11/1989	Uchida et al.	382/165 X
5,638,496	A		6/1997	Sato	395/109
5,678,155	A	*	10/1997	Miyaza	399/366

FOREIGN PATENT DOCUMENTS

JP	6-62242	*	3/1994
JP	8-180239	*	7/1996

* cited by examiner

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(57) **ABSTRACT**

Detection and deterrence of counterfeiting permits one to make legitimate color copies without introducing visual artifacts or experiencing substantial processing delays. An efficient counterfeit deterrence is enabled by the use of an hierarchic detection scheme, in which the majority of documents are classified as free of suspicion using a simple token detection algorithm that imposes a negligible computational burden. The remainder of documents, which are labeled as suspicious, receive analysis by one or more additional detection algorithms. If the suspicious document is identified as being a secure document, this will lead to printing with selectively deteriorated service or complete denial of service. For one embodiment, tokens having a characteristic color (or colors) and spacing, are incorporated into the design of frequently counterfeited documents. The scheme uses a color look-up table (LUT) to detect an initial token having the characteristic color. Upon detection of an initial token, a search is performed based on the expected token spacing in order to locate one or more additional tokens, and to thereby verify that printing of a counterfeit is being attempted. Conventional tests for counterfeit documents can also be used as a further, higher level test. A particularly effective higher level detector uses the locations of the detected tokens to determine orientation so that the suspected area can be compared with a corresponding portion of a secure document on a pixel-by-pixel basis. The invention has negligible impact on the time to render a page and negligible effect on general images and documents, while denying printing or generating visible artifacts on banknote or other secure document images. The scheme can be deployed in a printer driver with no hardware changes and can be adjusted to arrive at a compromise that allows reasonable detection, while causing minimal effect on legitimate users. Furthermore, this method can provide a visible indicator that currency is not counterfeit. Moreover, so long as the characteristic color and spacing of the tokens does not change, no alteration is required for a new series of notes.

20 Claims, 6 Drawing Sheets

(1 of 6 Drawing Sheet(s) Filed in Color)

