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Counterfeit Good Detection Using Radar

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COUNTERFEIT GOOD DETECTION USING RADAR

BACKGROUND

Counterfeit goods continue to be a problem in today's marketplace. Many goods, such as handbags and watches, can be so well counterfeited that a trained expert is needed to accurately determine whether the good is authentic or counterfeit. Counterfeit goods may be a particular issue during online transactions. For instance, a purchaser buying a good via an online auction site from a private seller may have to trust the seller's representation that the good is authentic since ascertaining any meaningful authenticity information from the posted pictures can be nearly impossible.

DETAILED DESCRIPTION

Radar, such as millimeter wave radar, may be used to detect whether a good is authentic or counterfeit. While a counterfeit item may be hard to discern from an authentic version of the item, certain properties that are detectible using radar may be telltale clues about whether the item is authentic or counterfeit. Radar technology may be incorporated into a hand-held device, such as a smartphone. The hand-held device may be configured to emit radar, such as frequency-modulated, continuous wave (FMCW) millimeter wave radar. A user may provide the hand-held device with basic information about the good to be tested for authenticity, such as a distance at which to hold the device from the good and a specific portion of the good at which the radar should be aimed. Radar may be emitted and the backscatter of the radar may be measured by the device. The backscatter may be analyzed locally or remotely by a server and compared to previously-collected data that is indicative of authentic and/or counterfeit versions

of the good. A determination and/or confidence of whether the good is authentic or counterfeit may be performed based on the analysis.

FIG. 1 illustrates a system in which mobile device 1 has incorporated radar componentry. Mobile device 1 may be a smartphone, cellular phone, gaming device, tablet computer, laptop computer, some other form of computerized-device, or a dedicated authenticity analyzer device. Mobile device 1 can have a significant number of components that are not indicated in the abstraction of FIG. 1; rather, mobile device 1 is meant to include only high-level components related to radar analysis used for counterfeit good detection. Mobile device 1 can include: radar module 2; transmitter 3; receiver 4; classification processing system 5; object profile datastore 6; and user interface 7.

Radar module 2 may cause transmitter 3 to output a radar pulse or FMCW radar. Transmitter 3 may emit radar in a particular direction. In some embodiments, radar module 2, transmitter 3, and receiver 4 are part of a single radar system that can be implemented as a SOC. A user, via user interface 7, may be instructed to aim transmitter 3 at particular portions of a good to be analyzed. In the illustrated embodiment, good 10 is a handbag. The handbag is representative of a type of good that may be analyzed for authenticity. Other possible goods can include watches, antiques, collectibles, clothing, etc. Such an analysis may be possible for a wide variety of physical goods. The transmitted radar may be reflected by good 10 and the backscattered radar may be received by receiver 4. Radar module 2 may perform signal processing on the received radar to identify characteristics of the good. The performed signal processing can include pulse compression and beam forming.

User interface 7 can be a display screen or touch screen interface. User interface 7 may be used to gather information from a user and provide instructions to the user. For instance, a user may provide input that identifies the make and model of good 10 that is to be tested for authenticity. In response, the user may be provided instructions indicative of the particular parts of good 10 that are to be imaged using the radar. For instance, for a handbag, particular portions of the stitching, material, and clasp may be imaged. The portions of good 10 to be imaged may be based on portions of the good that have been previously-identified to have a significantly different radar backscatter between the authentic and counterfeit versions of the good. For instance, while visually similar, particular portions of material composition, stitching, gluing, material thickness, or internal componentry may differ between the authentic and counterfeit versions of a good. The backscatter of radar may shift in wavelength based on the dielectric constant of the object which reflected the radar.

Radar module 2 may output data obtained from the radar backscatter to classification processing system 5. Classification processing system 5 may include one or more special-purpose or general-purpose processors. Such special-purpose processors may include processors that are specifically designed to perform the functions detailed herein. Such special-purpose processors may be ASICs or FPGAs which are general-purpose components that are physically and electrically configured to perform the functions detailed herein. Such general-purpose processors may execute special-purpose software that is stored using one or more non-transitory processor-readable mediums, such as random access memory (RAM), flash memory, a hard disk drive (HDD), or a solid state drive (SSD).

Classification processing system 5 can perform a comparison between data obtained from the radar backscatter to data stored in object profile datastore 6. Data stored in object

profile datastore 6, which can use one or more non-transitory processor-readable mediums, can include data representative of authentic and/or counterfeit versions of good 10. In particular, unique intensity measurements or signal patterns present in the backscatter can be indicative of an authentic or counterfeit good.

In some embodiments, the data stored in object profile datastore 6 may be obtained from cloud-based authenticity server 9 via network 8. When a user specifies the good to be analyzed via user interface 7, profile data about an authentic and/or counterfeit version of the good may be requested and received from cloud-based authenticity server 9 via network 8, which can include the Internet. The profile data obtained from cloud-based authenticity server 9 may be at least temporarily stored in object profile datastore 6.

In other embodiments, data from the radar backscatter received by radar module 2 may be output to cloud-based authenticity server 9 for remote analysis. Therefore, in some embodiments, the radar scanning performed using module device 1 is analyzed remotely by cloud-based authenticity server 9 and an indication (e.g., a confidence score) of whether good 10 is authentic or counterfeit can be returned. User interface 7 can be used to present a user with information about the analysis of good 10. For instance, an indication of whether good 10 is likely authentic or counterfeit may be presented along with a confidence. In some embodiments, the determination of authenticity and confidence may be output to a remote server (not pictured) via network 8. For instance, an application executed by module device 1, such as for an online auction site, may perform the authenticity analysis and output the result to a cloud-based server system of the online auction site. Such an arrangement may help ensure that a good that the user is posting for sale on the online auction site is authentic.

While the above description focuses on consumer goods, it should be understood that other embodiments are possible. For instance, semiconductor components or pharmaceutical goods can be analyzed and determined to be authentic or counterfeit using similar arrangements.

ABSTRACT

Radar, such as frequency-modulated continuous wave (FMCW), can be used to analyze characteristics of an item. The radar can be emitted by a mobile device, such as a smartphone, that has radar technology incorporated as part of it. The radar backscatter of various portions of an item can be analyzed to determine whether the item is likely counterfeit or authentic.

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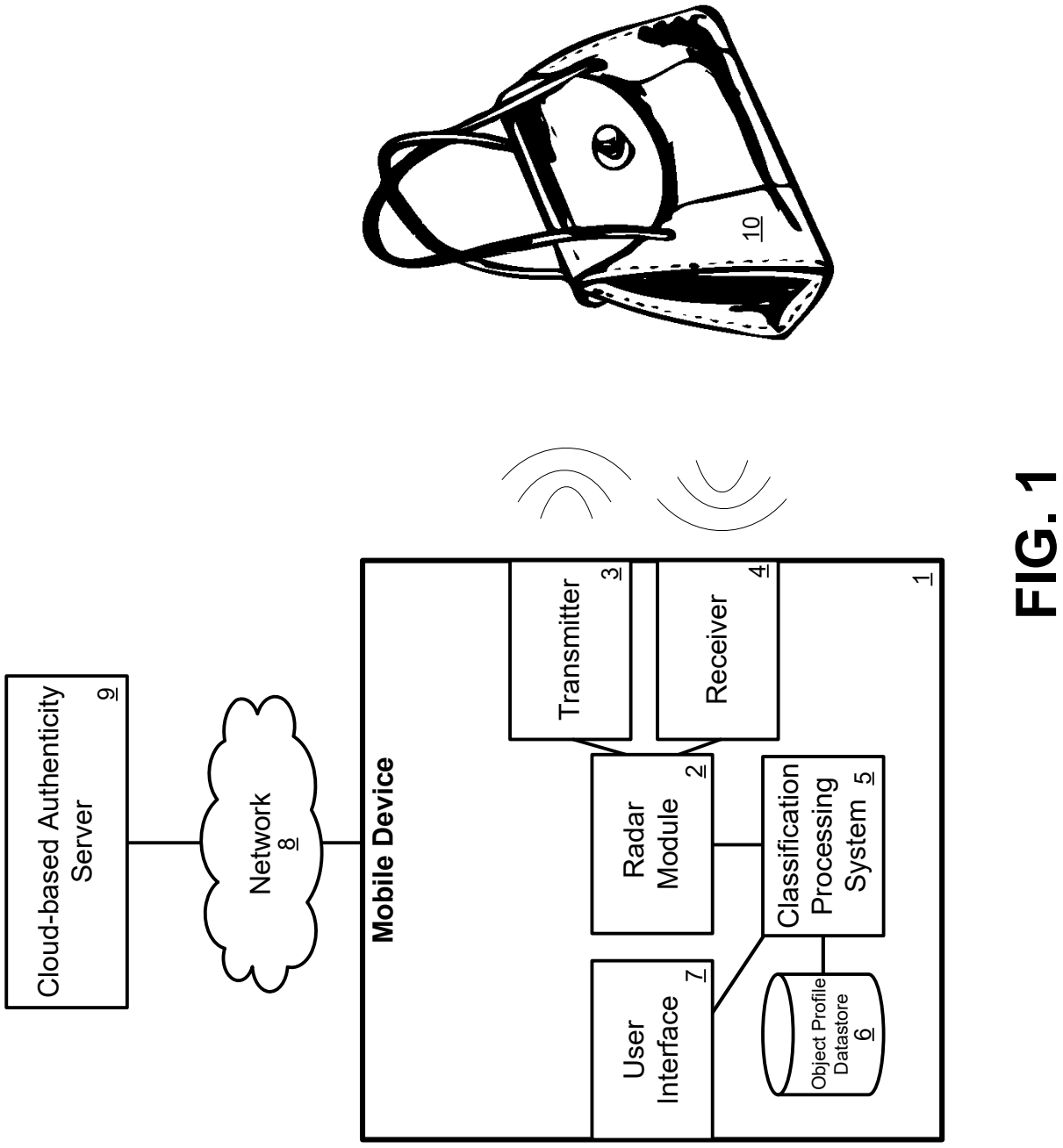

FIG. 1