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(54) SYSTEM AND METHOD FOR AUTHENTICATION AND PAYMENT WHILE WEARING A FACE COVERING

(71) Applicant: **Mastercard International Incorporated**, Purchase, NY (US)

(72) Inventors: **Sheldon Jackson**, St. Louis, MO (US); **Christopher T. Scholl**, Florissant, MO (US); **Aravind Mattaparthi**, O'Fallon, MO (US)

(73) Assignee: **Mastercard International Incorporated**, Purchase, NY (US)

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See application file for complete search history.

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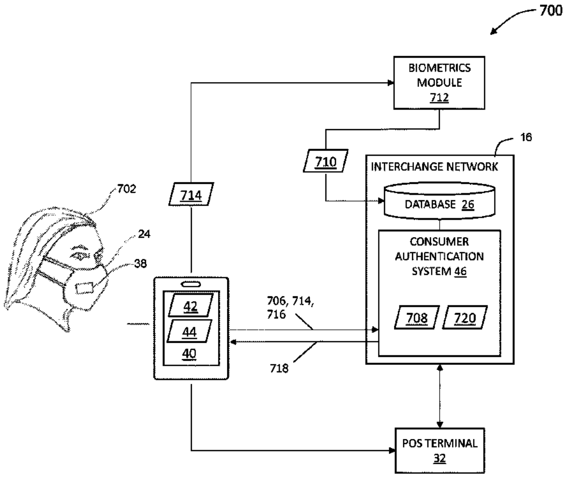
Primary Examiner — Calvin L Hewitt, II
Assistant Examiner — Steven R Chism
(74) *Attorney, Agent, or Firm* — Hovey Williams LLP

(57) **ABSTRACT**

The disclosure describes systems and methods for authenticating a consumer performing a digital wallet transaction while wearing a face covering. A consumer authentication system includes an electronic circuit device having a wireless transmitter chip associated with a unique identifier (UID). The system receives a transaction request message, and in response, transmits an authentication request message to the consumer. The system then receives an authentication response message from the consumer. The authentication response message includes a biometric sample of a select physical feature of the consumer. The system determines that the biometric sample matches the biometric profile of the consumer above a predetermined lower threshold and then reads a unique identifier (UID) from the electronic circuit device. The system determines whether the read unique identifier (UID) matches the unique identifier (UID) of the new consumer account.

11 Claims, 9 Drawing Sheets



(51) **Int. Cl.**

G06Q 20/36	(2012.01)
G06V 40/50	(2022.01)
H04W 68/00	(2009.01)

(52) **U.S. Cl.**

CPC ***G06Q 20/3674*** (2013.01); ***G06V 40/55*** (2022.01); ***H04W 68/005*** (2013.01)

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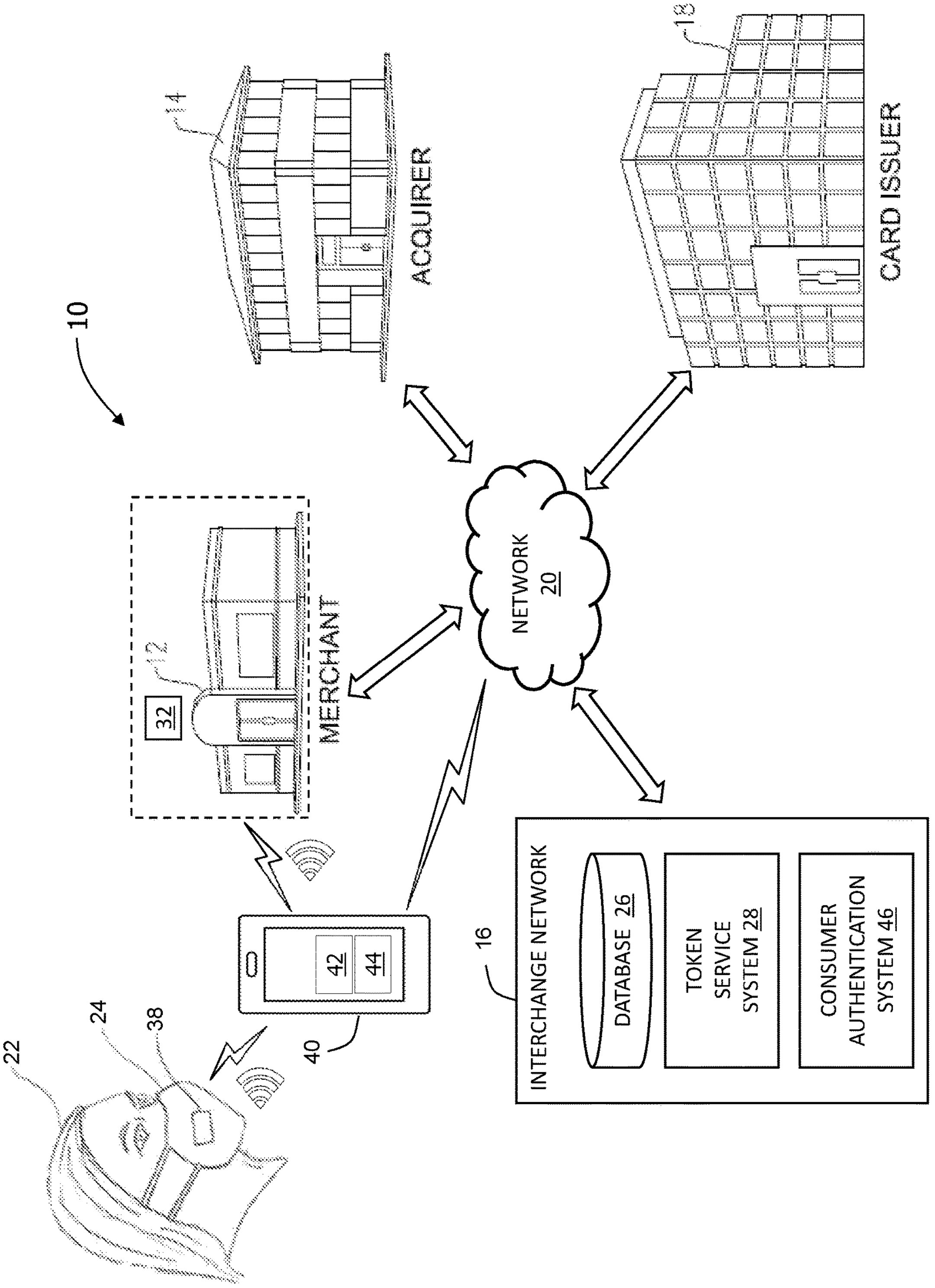
10
14
ACQUIRER
18
CARD ISSUER
12
32
MERCHANT
NETWORK 20
22
24
38
40
42
44
16
INTERCHANGE NETWORK
DATABASE 26
TOKEN SERVICE SYSTEM 28
CONSUMER AUTHENTICATION SYSTEM 46

FIG. 1

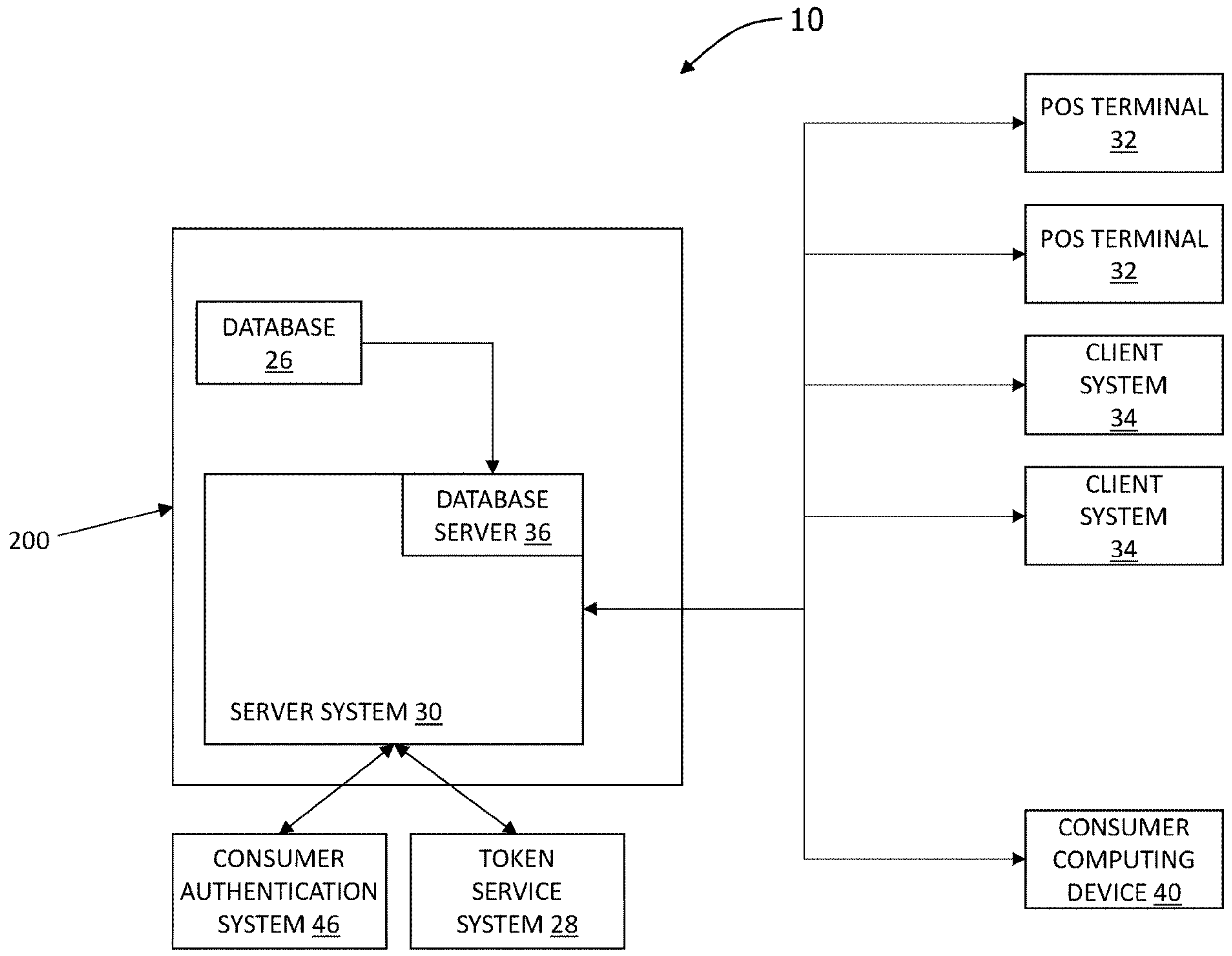
10
POS TERMINAL 32
POS TERMINAL 32
CLIENT SYSTEM 34
CLIENT SYSTEM 34
CONSUMER COMPUTING DEVICE 40
DATABASE 26
DATABASE SERVER 36
SERVER SYSTEM 30
200
CONSUMER AUTHENTICATION SYSTEM 46
TOKEN SERVICE SYSTEM 28

FIG. 2

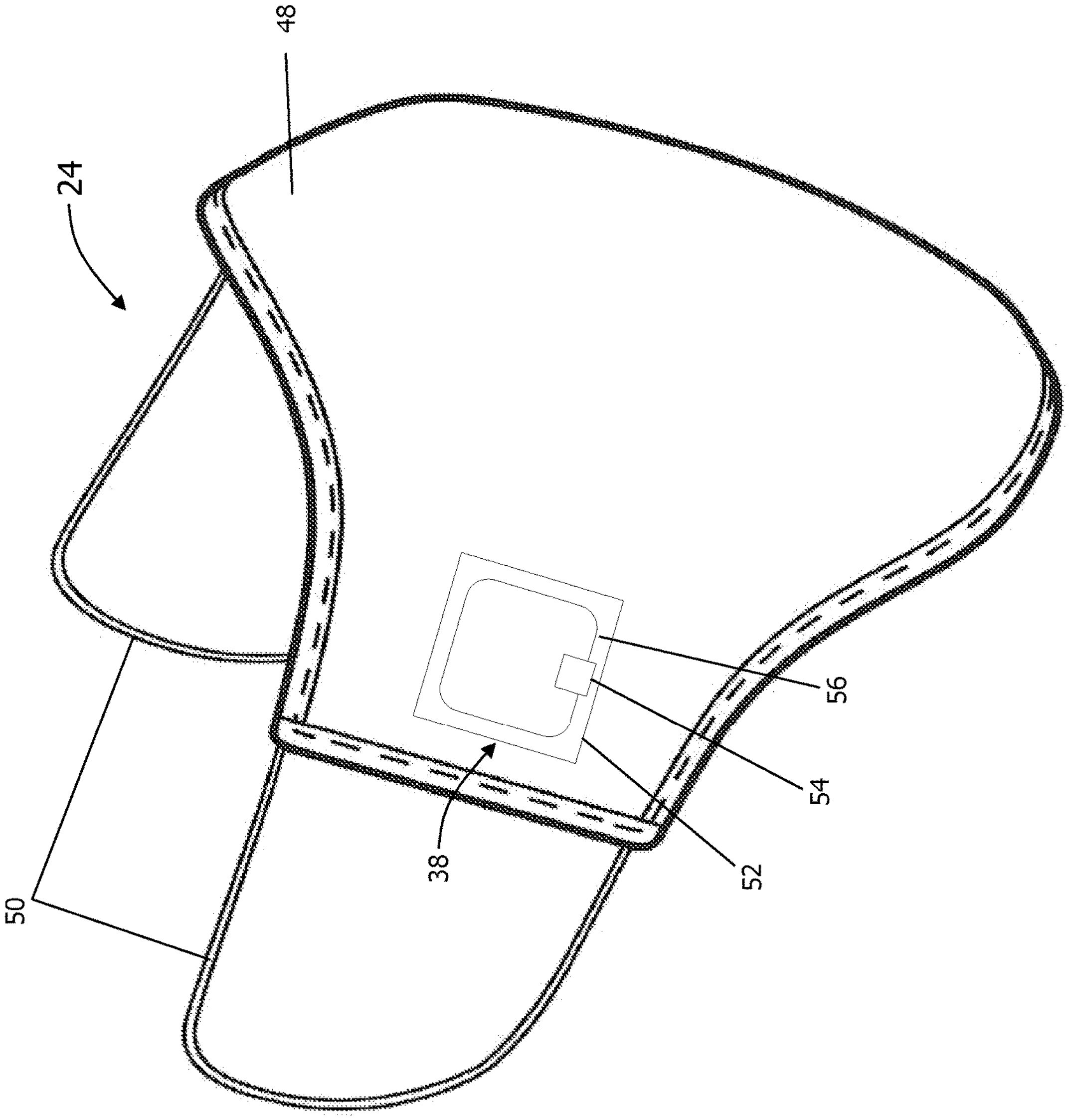

FIG. 3

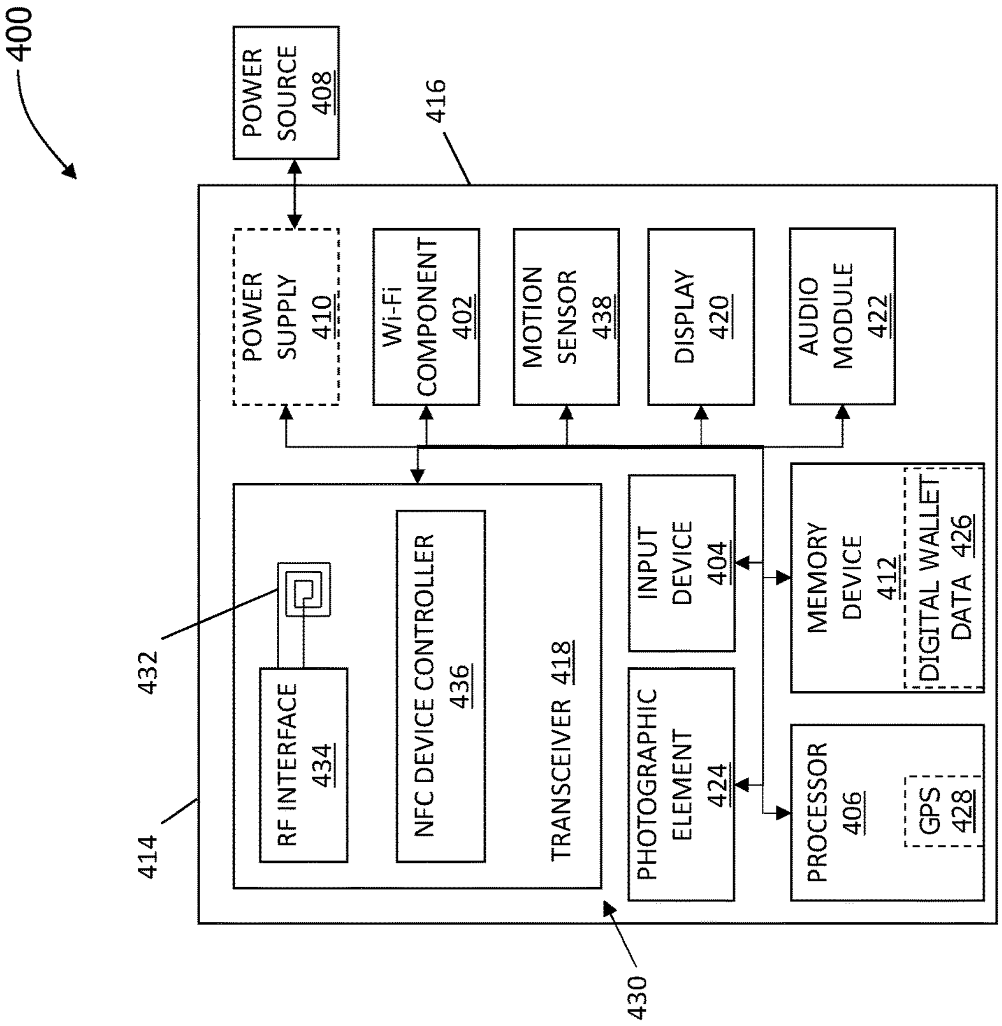
400
POWER SOURCE 408
416
POWER SUPPLY 410
Wi-Fi COMPONENT 402
MOTION SENSOR 438
DISPLAY 420
AUDIO MODULE 422
432
RF INTERFACE 434
NFC DEVICE CONTROLLER 436
TRANSCEIVER 418
INPUT DEVICE 404
MEMORY DEVICE 412
DIGITAL WALLET DATA 426
PHOTOGRAPHIC ELEMENT 424
PROCESSOR 406
GPS 428
414
430

FIG. 4

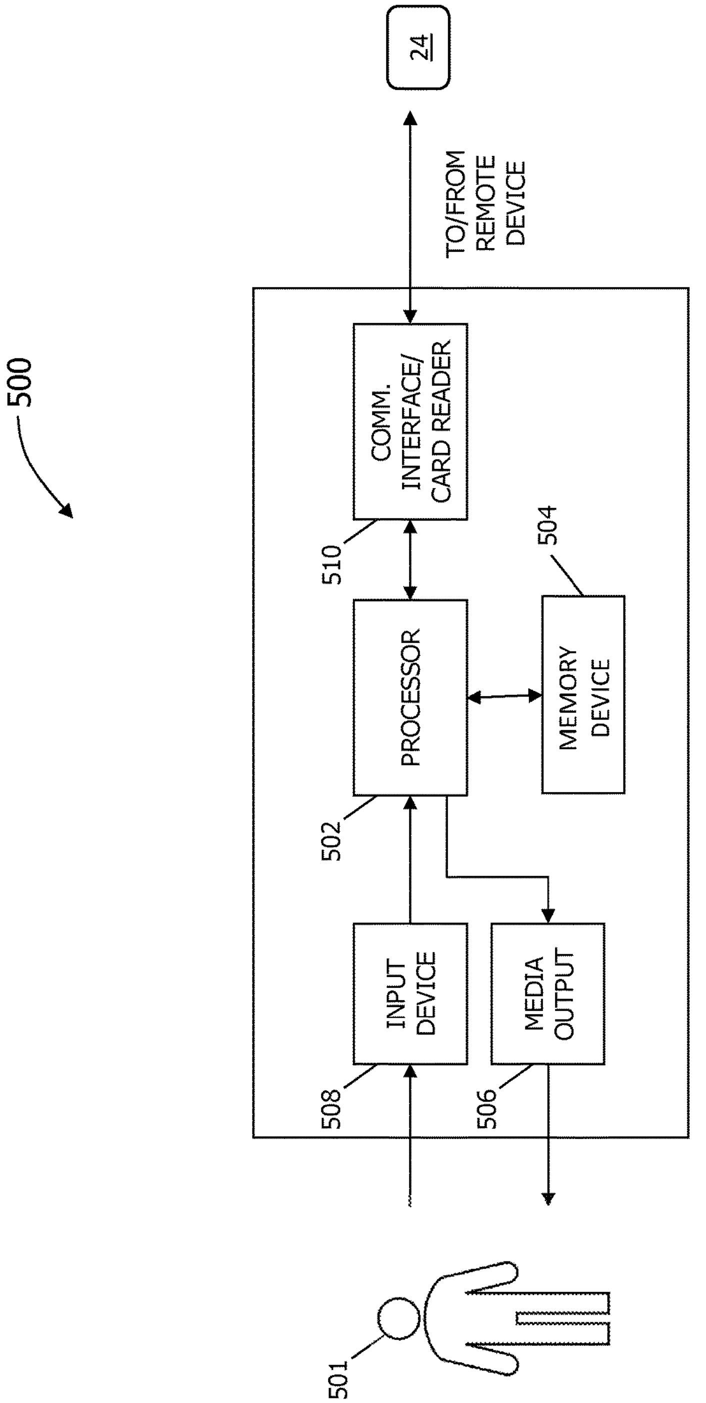
500
24
TO/FROM
REMOTE
DEVICE
COMM.
INTERFACE/
CARD READER
510
504
PROCESSOR
MEMORY
DEVICE
502
INPUT
DEVICE
MEDIA
OUTPUT
508
506
501

FIG. 5

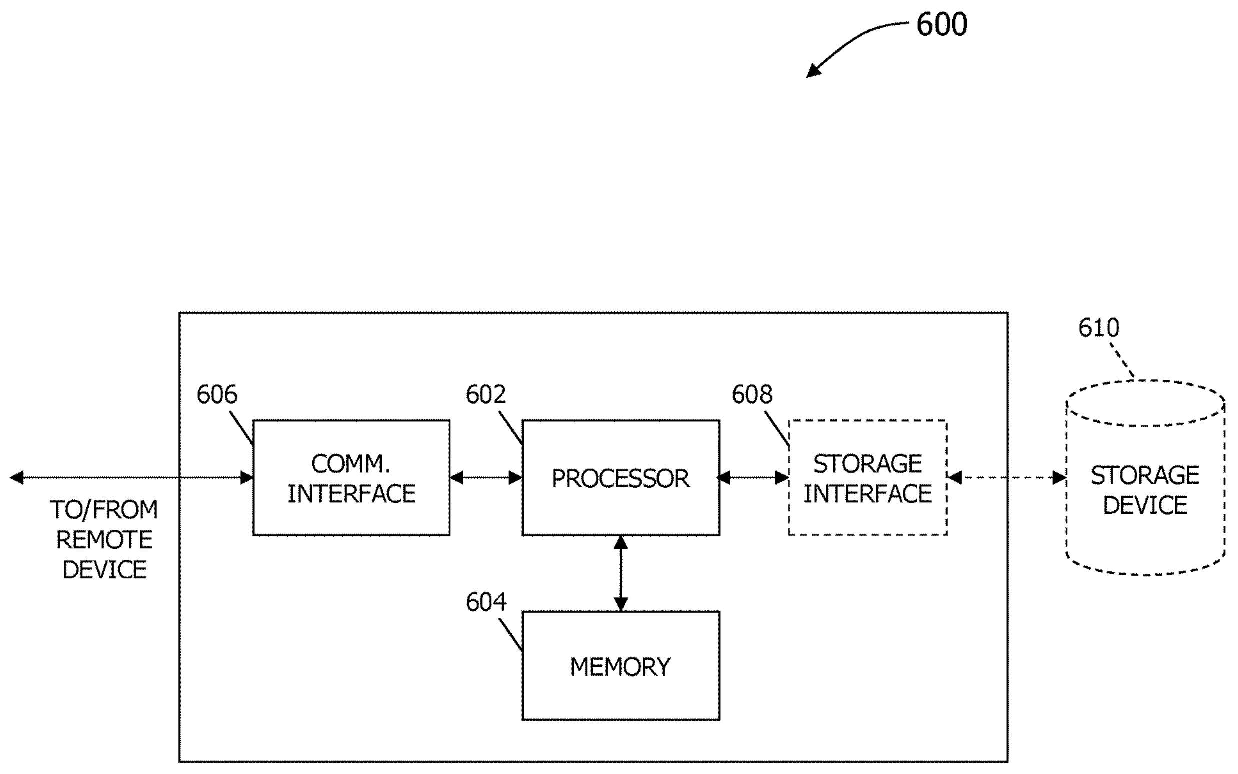
600
606
602
608
610
COMM.
INTERFACE
PROCESSOR
STORAGE
INTERFACE
STORAGE
DEVICE
TO/FROM
REMOTE
DEVICE
604
MEMORY

FIG. 6

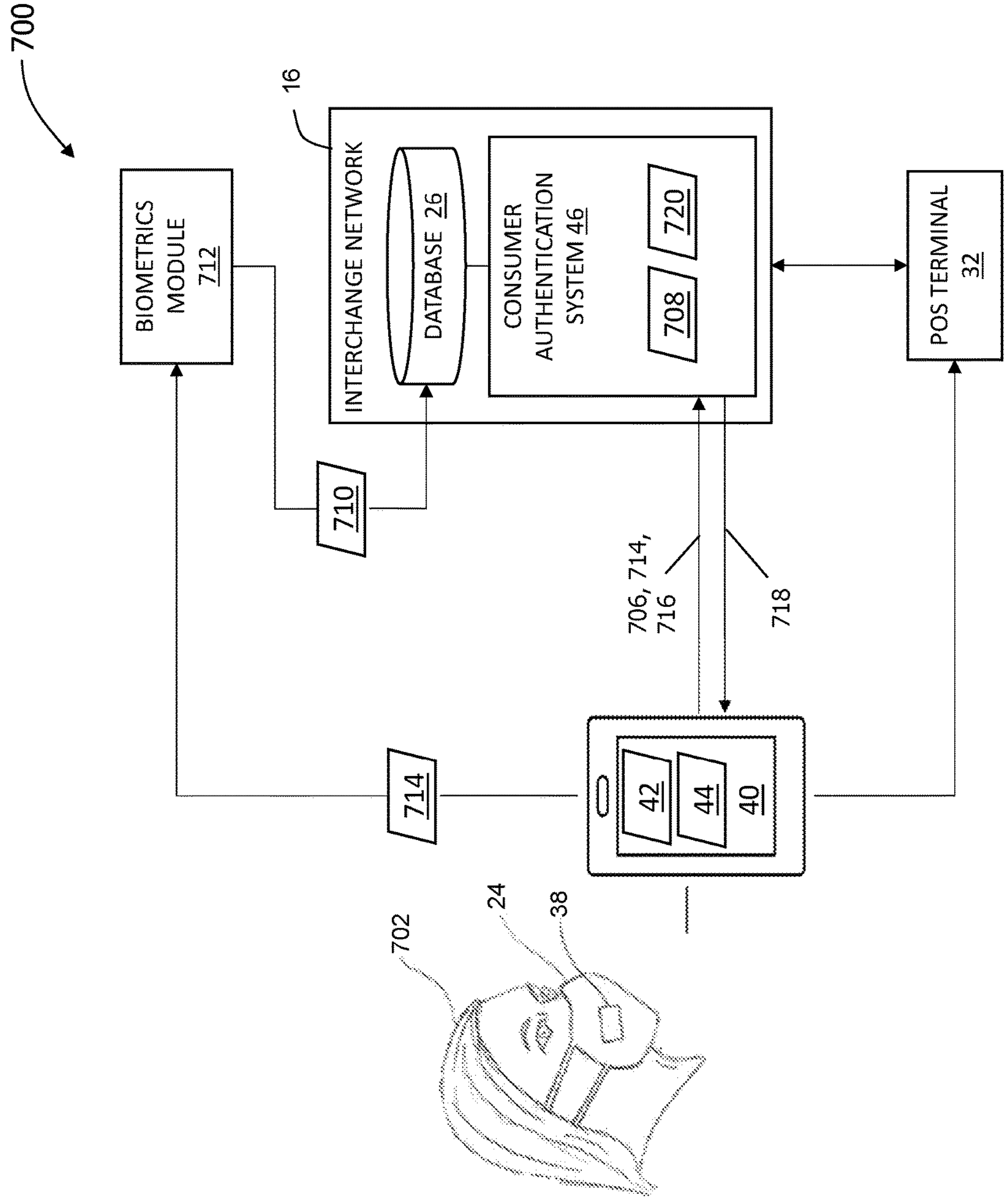
700
16
BIOMETRICS MODULE 712
INTERCHANGE NETWORK
DATABASE 26
CONSUMER AUTHENTICATION SYSTEM 46
708
720
POS TERMINAL 32
710
706, 714, 716
718
714
42
44
40
702
24
38

FIG. 7

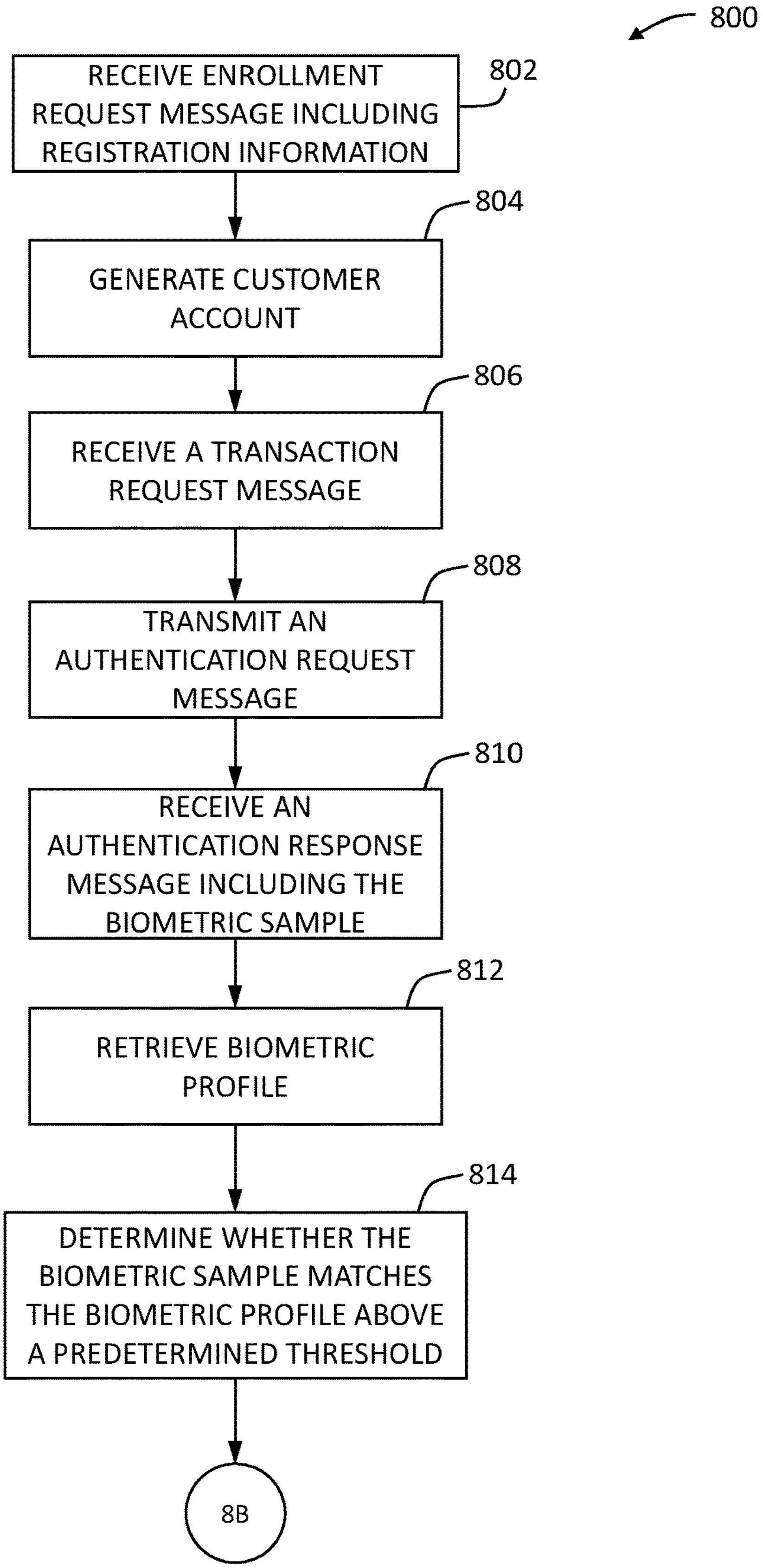
800
RECEIVE ENROLLMENT REQUEST MESSAGE INCLUDING REGISTRATION INFORMATION
802
GENERATE CUSTOMER ACCOUNT
804
RECEIVE A TRANSACTION REQUEST MESSAGE
806
TRANSMIT AN AUTHENTICATION REQUEST MESSAGE
808
RECEIVE AN AUTHENTICATION RESPONSE MESSAGE INCLUDING THE BIOMETRIC SAMPLE
810
RETRIEVE BIOMETRIC PROFILE
812
DETERMINE WHETHER THE BIOMETRIC SAMPLE MATCHES THE BIOMETRIC PROFILE ABOVE A PREDETERMINED THRESHOLD
814
8B

FIG. 8A

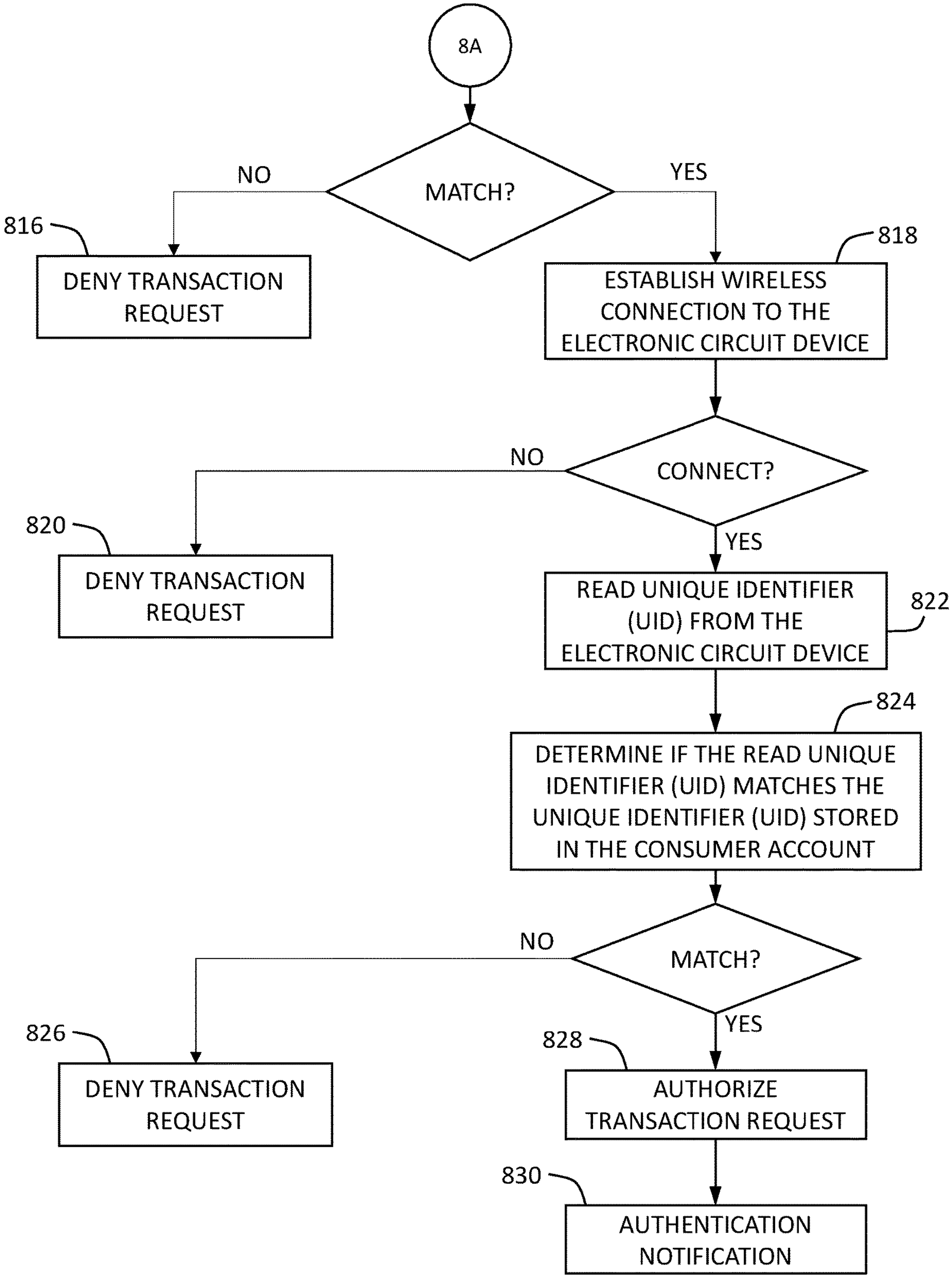
8A
MATCH?
NO
YES
816
DENY TRANSACTION REQUEST
818
ESTABLISH WIRELESS CONNECTION TO THE ELECTRONIC CIRCUIT DEVICE
CONNECT?
NO
YES
820
DENY TRANSACTION REQUEST
READ UNIQUE IDENTIFIER (UID) FROM THE ELECTRONIC CIRCUIT DEVICE
822
824
DETERMINE IF THE READ UNIQUE IDENTIFIER (UID) MATCHES THE UNIQUE IDENTIFIER (UID) STORED IN THE CONSUMER ACCOUNT
MATCH?
NO
YES
826
DENY TRANSACTION REQUEST
828
AUTHORIZE TRANSACTION REQUEST
830
AUTHENTICATION NOTIFICATION

FIG. 8B

SYSTEM AND METHOD FOR AUTHENTICATION AND PAYMENT WHILE WEARING A FACE COVERING

FIELD OF THE DISCLOSURE

The field of the disclosure relates generally to authenticating a consumer wearing a face covering during a digital wallet transaction and, more particularly, to a payment application that utilizes biological factors and wireless sensor technology to authenticate a transaction.

BACKGROUND OF THE DISCLOSURE

With a rise in infectious diseases and the rapid spread of novel viruses, many countries, states, counties, and cities implement face mask mandates. The face mask mandates are meant to facilitate reducing the spread of such diseases and viruses. However, many mobile devices use facial recognition technology to authenticate a user and perform various functions. For example, many digital wallet applications installed on such mobile devices require user authentication to perform contactless payment transactions. When a user is wearing a face mask, however, the facial recognition generally fails, which results in an unsuccessful transaction. To use the mobile device, the user is typically required to remove his or her face mask, or type in a PIN. Such actions defeat the purpose of contactless transactions and may leave the user exposed to such diseases and viruses.

BRIEF DESCRIPTION OF THE DISCLOSURE

This brief description is provided to introduce a selection of concepts in a simplified form that are further described in the detailed description below. This brief description is not intended to identify key features or essential features of the claimed subject matter, nor is it intended to be used to limit the scope of the claimed subject matter. Other aspects and advantages of the present disclosure will be apparent from the following detailed description of the embodiments and the accompanying figures.

In one aspect, a consumer authentication system is provided. The consumer authentication system includes an electronic circuit device and a consumer authentication computing system. The electronic circuit device includes a wireless transmitter chip that has a unique identifier (UID) stored thereon. The electronic circuit device is configured to wirelessly transmit the unique identifier (UID). The consumer authentication computing system includes a memory device for storing data and a processor communicatively coupled to the memory device. The processor is configured to perform operations to receive account registration information from a consumer computing device associated with a consumer. The account registration information includes the unique identifier (UID). The processor is configured to generate a new consumer account. The new consumer account includes the account registration information and the unique identifier (UID). The processor is also configured to receive a biometric profile of the consumer. The biometric profile includes a digital representation of a select physical feature of the consumer. Furthermore, the processor is configured to store the new consumer account and the biometric profile on the memory device, and to receive, from the consumer computing device, a transaction request message including a transaction request. In response to the transaction request, the processor transmits an authentication request message to the consumer computing device. The processor is also configured to receive an authentication response message from the consumer computing device. The authentication response message includes a biometric sample of the select physical feature of the consumer. Moreover, the processor is configured to determine that the biometric sample matches the biometric profile of the consumer above a predetermined lower threshold. The processor reads the unique identifier (UID) from the electronic circuit device and determines whether the read unique identifier (UID) matches the unique identifier (UID) of the new consumer account.

In another aspect, a method is provided. The method includes receiving account registration information from a consumer computing device associated with a consumer. The account registration information includes a first unique identifier (UID). The method also includes generating a new consumer account. The new consumer account includes the account registration information and the first unique identifier (UID). The method also includes receiving a biometric profile of the consumer. The biometric profile includes a digital representation of a select physical feature of the consumer. Furthermore, the method includes storing the new consumer account and the biometric profile in a memory device of a consumer authentication computing system. The method includes receiving, from the consumer computing device, a transaction request message including a transaction request, and in response to the transaction request, transmitting an authentication request message to the consumer computing device. Moreover, the method includes receiving an authentication response message from the consumer computing device. The authentication response message includes a biometric sample of the select physical feature of the consumer. The method includes determining that the biometric sample matches the biometric profile of the consumer above a predetermined lower threshold and reading a second unique identifier (UID) from an electronic circuit device associated with the consumer. In addition, the method includes determining whether the second unique identifier (UID) matches the first unique identifier (UID).

A variety of additional aspects will be set forth in the detailed description that follows. These aspects can relate to individual features and to combinations of features. Advantages of these and other aspects will become more apparent to those skilled in the art from the following description of the exemplary embodiments which have been shown and described by way of illustration. As will be realized, the present aspects described herein may be capable of other and different aspects, and their details are capable of modification in various respects. Accordingly, the figures and description are to be regarded as illustrative in nature and not as restrictive.

BRIEF DESCRIPTION OF THE DRAWINGS

The figures described below depict various aspects of systems and methods disclosed therein. It should be understood that each figure depicts an embodiment of a particular aspect of the disclosed systems and methods, and that each of the figures is intended to accord with a possible embodiment thereof. Further, wherever possible, the following description refers to the reference numerals included in the following figures, in which features depicted in multiple figures are designated with consistent reference numerals.

FIG. **1** is a block diagram of an example multi-party payment network system, in accordance with one embodiment of the present disclosure;

FIG. **2** is a simplified block diagram of an example payment network system, such as the payment network system shown in FIG. **1**, including a plurality of computing devices and the consumer authentication computing system;

FIG. **3** is a schematic perspective view of the face covering for use in the payment network system shown in FIG. **1**;

FIG. **4** is an example configuration of a user computing system for use in the payment network system shown in FIG. **1**;

FIG. **5** is an example configuration of a computing system for use in the payment network system shown in FIG. **1**;

FIG. **6** is an example configuration of a server system for use in the payment network system shown in FIG. **1**; and

FIG. **7** is a schematic diagram showing operation of the consumer authentication system; and

FIGS. **8**A and **8**B cooperatively depict a flow diagram of an exemplary computer-implemented method for registering and authenticating a consumer during a transaction using a consumer computing device, in accordance with one embodiment of the present disclosure.

Unless otherwise indicated, the figures provided herein are meant to illustrate features of embodiments of this disclosure. These features are believed to be applicable in a wide variety of systems comprising one or more embodiments of this disclosure. As such, the figures are not meant to include all conventional features known by those of ordinary skill in the art to be required for the practice of the embodiments disclosed herein.

DETAILED DESCRIPTION OF THE DISCLOSURE

The following detailed description of embodiments of the invention references the accompanying figures. The embodiments are intended to describe aspects of the invention in sufficient detail to enable those with ordinary skill in the art to practice the invention. The embodiments of the invention are illustrated by way of example and not by way of limitation. Other embodiments may be utilized, and changes may be made without departing from the scope of the claims. The following description is, therefore, not limiting. The scope of the present invention is defined only by the appended claims, along with the full scope of equivalents to which such claims are entitled.

As used herein, the term "database" includes either a body of data, a relational database management system (RDBMS), or both. As used herein, a database includes, for example, and without limitation, a collection of data including hierarchical databases, relational databases, flat file databases, object-relational databases, object oriented databases, and any other structured collection of records or data that is stored in a computer system. Examples of RDBMS's include, for example, and without limitation, Oracle® Database (Oracle is a registered trademark of Oracle Corporation, Redwood Shores, Calif.), MySQL, IBM® DB2 (IBM is a registered trademark of International Business Machines Corporation, Armonk, N.Y.), Microsoft® SQL Server (Microsoft is a registered trademark of Microsoft Corporation, Redmond, Wash.), Sybase® (Sybase is a registered trademark of Sybase, Dublin, Calif.), and PostgreSQL® (PostgreSQL is a registered trademark of PostgreSQL Community Association of Canada, Toronto, Canada). However, any database may be used that enables the systems and methods to operate as described herein.

As used herein, the terms "payment card," "transaction card," and "financial transaction card," may include any suitable transaction card, such as a credit card, a debit card, a charge card, a membership card, a promotional card, an identification card, a prepaid card, a gift card, and/or any other card-type device that may hold payment account information. Each type of transaction card can be used as a method of payment for performing a transaction.

Furthermore, as used herein, the term "real-time" includes at least one of the times of occurrence of the associated events, the time of collection of data, the time to process the data, and the time of a system response to the events and the environment. For the activities and the events in the embodiments described herein as occurring in real-time, it should be assumed that they occur substantially instantaneously.

Payment Network Systems

FIG. **1** is a block diagram of an example multi-party payment network system **10**. The payment network system **10** facilitates providing interchange network services offered by an interchange network **16**. In addition, the payment network system **10** enables contactless payment transactions, for example, by a consumer computing device **40**. In the payment network system **10**, merchants **12**, acquirers **14**, and/or issuers **18** do not need to have a one-to-one relationship. Although parts of the payment network system **10** are presented in one arrangement, other embodiments may include the same or different parts arranged otherwise, depending, for example, on authorization processes for purchase transactions, communication between computing devices, etc. As used herein, the term "interchange network" includes an electronic network that exchanges data relating to the value of card account sales and credits among the issuers **18** and the acquirers **14** (e.g., networks maintained, for example, by Mastercard©). (Mastercard is a registered trademark of Mastercard International Incorporated.)

In the exemplary embodiment, the consumer computing device **40** (e.g., a smartphone or other computing device used by the consumer **22**) includes a user interface (not labelled) that facilitates user interaction with the respective consumer computing device **40**. For example, and without limitation, the user interface enables the consumer **22** to input information to the consumer computing device **40**, and the consumer computing device **40** to output information to the consumer **22** (e.g., on a display of the consumer computing device **40**). The user interface includes, for example, a digital wallet application **42** (broadly, a digital wallet), which is installed on the consumer computing device **40**. It is contemplated that fewer or more digital wallets may be installed on the consumer computing device **40** and displayed by the user interface, where each digital wallet is associated with at least one financial institution (not shown).

The consumer computing device **40** can be any computing device capable of interconnecting to the network **20**, such as the Internet, including a mobile web-based device, smartphone, PDA, or other mobile web-based connectable equipment. The consumer computing device **40** is interconnected to the Internet through one or more interfaces including a network, such as a local area network (LAN) or a wide area network (WAN), dial-in-connections, cable modems, wireless modems, and special high-speed ISDN lines. In addition, in the example embodiment, the consumer computing device **40** is configured to communicate with other user computing devices and/or merchant point-of-sale (POS) systems **32** using various forms of communication including, for example, radio frequency communication, near field communication (NFC), network-based communication, and the like.

In the example embodiment, the payment network system **10** generally includes the merchants **12**, the acquirers **14**, the interchange network **16**, and the issuers **18** coupled in communication via a network **20**. The network **20** includes, for example and without limitation, one or more of a local area network (LAN), a wide area network (WAN) (e.g., the Internet, etc.), a mobile network, a virtual network, and/or any other suitable public and/or private network capable of facilitating communication among the merchants **12**, the acquirers **14**, the interchange network **16**, and/or the issuers **18**. In some embodiments, the network **20** may include more than one type of network, such as a private payment transaction network provided by the interchange network **16** to the acquirers **14** and/or the issuers **18**, and, separately, the public Internet, which may facilitate communication between the merchants **12**, the interchange network **16**, the acquirers **14**, and consumers **22**, etc.

Embodiments described herein may relate to a transaction card system, such as a credit card payment system using the Mastercard interchange network. The Mastercard interchange network is a set of proprietary communications standards promulgated by Mastercard for the exchange of financial transaction data and the settlement of funds between financial institutions that are members of Mastercard. As used herein, financial transaction data includes a unique account number associated with an account holder using a payment card issued by an issuer, purchase data representing a purchase made by the consumer, including a type of merchant, amount of purchase, date of purchase, and other data, which may be transmitted between any parties of multi-party payment network system **10**.

In a transaction card system as described herein, a financial institution called the "issuer" issues a payment card account (not shown) to a cardholder or consumer **22**, who uses the payment card account to tender payment for a purchase from the merchant **12**. In the example embodiment, the merchant **12** is typically associated with products, for example, and without limitation, goods and/or services, that are offered for sale and are sold to the consumers **22**. The merchant **12** includes, for example, a physical location and/or a virtual location. A physical location includes, for example, a brick-and-mortar store, etc., and a virtual location includes, for example, an Internet-based store-front.

To accept payment with the payment card account, the merchant **12** must normally establish an account with a financial institution that is part of the payment network system **10**. This financial institution is usually called the "merchant bank," the "acquiring bank," or the acquirer **14**. When the consumer **22** provides payment for a purchase with the payment card account (e.g., via a payment card or digital wallet), the merchant **12** requests authorization from the acquirer **14** for the purchase amount. The request may be performed over the telephone but is usually performed using a point-of-sale (POS) terminal, such as the POS terminal **32**, that wirelessly connects to the consumer computing device **40** and reads the consumer's payment account information, such as a payment token **44** (broadly, digital wallet data) tied to a primary account number (PAN), from a memory device of the consumer computing device **40** and communicates electronically with the transaction processing computers of the acquirer **14**. Alternatively, the acquirer **14** may authorize a third party to perform transaction processing on its behalf. In this case, the POS terminal **32** will be configured to communicate with the third party. Such a third party is usually called a "merchant processor," an "acquiring processor," or a "third party processor."

Using the interchange network **16**, computers of the acquirer **14** or merchant processor will communicate with computers of the issuer **18** to determine whether the consumer's account is in good standing and whether the purchase is covered by the consumer's available credit line. Based on these determinations, the request for authorization will be declined or accepted. If the request is accepted, an authorization code is issued to the merchant **12**.

When a request for authorization is accepted, the available credit line of the consumer's account is decreased. Normally, a charge for a payment card transaction is not posted immediately to the consumer's account because bankcard associations, such as Mastercard, have promulgated rules that do not allow the merchant **12** to charge, or "capture," a transaction until the purchased goods are shipped or the purchased services are delivered. However, with respect to at least some debit card transactions, a charge may be posted at the time of the transaction. When the merchant **12** ships or delivers the goods or services, the merchant **12** captures the transaction by, for example, appropriate data entry procedures on the POS terminal **32**. This may include bundling of approved transactions daily for standard retail purchases. If the consumer **22** cancels a transaction before it is captured, a "void" is generated. If the consumer **22** returns goods after the transaction has been captured, a "credit" is generated. The interchange network **16** and/or the issuer **18** stores the transaction data, such as, and without limitation, the PAN, a type of merchant, a merchant identifier, a location where the transaction was completed, an amount of purchase, a merchant category code, a date and time of the transaction, products purchased and related descriptions or identifiers, etc., in a transaction database **26**.

After a purchase has been made, a clearing process occurs to transfer additional transaction data related to the purchase among the parties to the transaction, such as the acquirer **14**, the interchange network **16**, and the issuer **18**. More specifically, during and/or after the clearing process, additional data, such as a time of purchase, a merchant name, a type of merchant, purchase information, consumer account information, a type of transaction, itinerary information, information regarding the purchased item and/or service, and/or other suitable information, is associated with a transaction and transmitted between the parties to the transaction as transaction data, and may be stored by any of the parties to the transaction.

After a transaction is authorized and cleared, the transaction is settled among the merchant **12**, the acquirer **14**, and the issuer **18**. Settlement refers to the transfer of financial data or funds among the merchant **12**, the acquirer **14**, and the issuer **18** related to the transaction. Usually, transactions are captured and accumulated into a "batch," which is settled as a group. More specifically, a transaction is typically settled between the issuer **18** and the interchange network **16**, and then between the interchange network **16** and the acquirer **14**, and then between the acquirer **14** and the merchant **12**. It should be appreciated that more or less information related to transactions, as part of either authorization, clearing, and/or settling, may be included in the transaction data and stored within the transaction database **26**, at the merchant **12**, the acquirer **14**, the payment network **16**, and/or the issuer **18**. Further, transaction data, unrelated to a particular payment account, may be collected by a variety of techniques, and similarly stored within the transaction database **26**.

In some embodiments, consumers **22** involved in the transactions described herein are prompted to agree to legal terms associated with their payment accounts, for example, during enrollment in such payment accounts, etc. As such, the consumer **22** may voluntarily agree to allow the merchants **12**, the issuers **18**, the interchange network **16**, etc., to utilize data collected during enrollment and/or collected relating to processing the transactions, subsequently for one or more of the purposes described herein.

As described above, the payment token **44** and/or the consumer's PAN is passed from the consumer computing device **40** to the POS terminal **32**. In many instances, the payment token **44** and/or the PAN and the associated expiry date may be saved to various databases, such as the database **26**. Contactless digital wallet transactions are generally performed in EMV mode. Contactless EMV mode is more secure than traditional mag-stripe mode (e.g., for use with physical payment cards) and includes a unique cryptogram for the specific transaction. Digital wallet transactions initiated by the consumer computing device **40** at the POS terminal **32** typically include tokenized account data (such data including, for example, the PAN and the expiry date). As a result, the possibility of the actual PAN and expiry date of a payment card account to be exposed to fraudsters, for example, via a data breach, is substantially decreased.

Thus, referring back to FIG. **1**, the interchange network **16** includes a token service system **28**, which is configured to generate or assign one or more contactless payment tokens, such as payment token **44**, to respective payment card accounts that are to be tokenized. Tokenization can be performed, for example, at the POS terminal **32**, at a consumer computing device **40**, a contactless ATM, and the like. The consumer computing device **40**, for example, may include a banking application or digital wallet application **42** executing thereon to facilitate tokenizing the payment card account, storing the payment token **44**, and/or performing a transaction with the payment token **44**.

During a tokenization operation, for example, being performed at the consumer computing device **40**, the PAN is sent to the card issuer **18** along with a request message to tokenize the PAN. In some embodiments, the card issuer **18** may evaluate risk associated with the token request message and perform other assessments and/or processing before approving and transmitting the token request message to the token service system **28**. The token service system **28** generates or assigns a contactless payment token to the PAN to be tokenized and creates an association mapping between the contactless token and the PAN. The token service **28** stores the contactless token-to-PAN mapping data (e.g., in a data mapping table) in a database, such as the database **26**. The token service system **28** transmits the payment token **44**, for example, to the consumer computing device **40** such that the payment token **44** can be written to and stored on the consumer computing device **40**. This process is generally the same whether being performed at a POS terminal **32**, a contactless ATM, or any other suitable NFC enabled device.

The interchange network **16** also includes a consumer authentication computing system **46** that is configured to analyze various data associated with the consumer, such as biometric data and a unique identifier (UID), to authenticate a user of the consumer computing device **40** before performing a transaction. In particular, in the example embodiment, the consumer authentication computing system **46** is a specially programmed computer system that enables the interchange network **16** to implement an automated process to identify and authenticate the consumer **22** who may be wearing a face covering **24**, and as such, who may be unable to be authenticated via a traditional facial recognition process. To facilitate the authentication process, the face covering **24** includes an electronic circuit device **38** configured to wirelessly transmit a unique identifier (UID), for example, to the consumer computing device **40**.

In the example embodiment, the consumer authentication computing system **46** is programmed to communicate with one or more consumer computing devices, such as the consumer computing device **40**, via digital wallet application **42**, to receive account registration information (not shown in FIG. **1**) to facilitate establishing an account that is not registered with the consumer authentication computing system **46**. In particular, the account registration process creates a consumer account and associated credentials for use with the consumer authentication computing system **46** and/or the digital wallet application **42**. The consumer **22** enters the account registration information for transmission to the consumer authentication computing system **46**. The account registration information may include, for example, and without limitation, payment account data (e.g., the PAN, a virtual payment number, limited use number, etc.), identification data of the consumer computing device **40** (e.g., an Electronic Serial Number (ESN), Mobile Equipment Identifier (MEID), International Mobile Equipment Identity (IMEI) number, and the like), the unique identifier (UID) associated with the electronic circuit device **38**, and/or biometric data of the consumer **22**, as described herein. The account registration information may be stored in a database, such as the database **26**. The consumer authentication computing system **46** generates a consumer account from the account registration information for the consumer **22**.

To authenticate the consumer **22**, in the example embodiment, the consumer authentication computing system **46** is programmed to receive a biometric profile (not shown in FIG. **1**) from a database or biometrics module (not shown in FIG. **1**). The consumer authentication computing system **46** is also programmed to receive the unique identifier (UID) associated with the electronic circuit device **38** from the consumer computing device **40**. The biometric profile may include, for example, biometric data associated with the consumer **22**, i.e., one or more scans or digital representations of select physical features of the consumer **22** that are to be validated during authentication requests for transactions via the digital wallet application **42**. The biometric data or physical features of the consumer **22** can include, for example, and without limitation, facial features, iris features, vein patterns, and the like. The biometric profile may be stored, for example, in the biometrics module or the database **26**. The consumer authentication computing system **46** supplements the consumer profile with the biometric profile. The biometrics module is programmed to receive the one or more scans or digital representations of physical features from the consumer computing device **40** and use the scans or digital representations to generate the biometric profile and/or validate the scans or digital representations against the biometric profile. Validation of the one or more scans or digital representations may include validating a portion of the one or more scans or digital representations and verifying that the unique identifier (UID) corresponds to the validated scans or digital representations, for example, in the consumer profile.

While only one merchant **12**, acquirer **14**, interchange network **16**, and issuer **18** are shown in FIG. **1** (for ease of reference), it should be appreciated that a variety of other embodiments may include multiple ones of these parties in various combinations.

FIG. **2** is a simplified block diagram of an example payment network system, such as the payment network system **10**, including a plurality of computing devices, the token service system **28**, and the consumer authentication computing system **46**. In the example embodiment, the plurality of computing devices include, for example, a processing system **200** having a server system **30**, POS terminals **32** located at merchants, such as the merchant **12** (shown in FIG. **1**), client systems **34** (e.g., contactless ATMs, computers, etc.) associated with merchants, merchant banks, payment networks, and/or issuer banks (e.g., the issuer **18** (shown in FIG. **1**)), and the computing device **40** associated with the consumer **22** (shown in FIG. **1**). In one embodiment, the payment network system **10** implements a process for authenticating the consumer **22** while the consumer is wearing the facial covering **24**.

In the exemplary embodiment, as described above, the processing system **200** includes the server system **30** of, for example, the interchange network **16** (shown in FIG. **1**), coupled in communication with the POS terminals **32**, the client systems **34** (also includes client sub-systems), and the consumer computing device **40**. In one embodiment, the client systems **34** and the consumer computing device **40** are computers that include a web browser, such that the server system **30** is accessible to the client systems **34** and the consumer computing device **40** using the Internet. The client systems **34** and the consumer computing device **40** are interconnected to the Internet through any one or more of many interfaces including, for example, a network, such as a LAN or WAN, dial-in-connections, cable modems, and/or special high-speed Integrated Services Digital Network (ISDN) lines. The client systems **34** and consumer computing device **40** could be any device capable of interconnecting to the Internet including an Internet connected phone, a PDA, or any other suitable web-based connectable equipment.

The POS terminals **32** may be connected to the client systems **34** or may be connected to the server system **30**. The POS terminals **32** may be interconnected to the Internet (or any other network that allows the POS terminals **32** to communicate as described herein) through any one or more of many possible interfaces including a network, such as a local area network (LAN) or a wide area network (WAN), dial-in-connections, cable modems, wireless modems, and special high-speed ISDN lines. The POS terminals **32** are any device capable of interconnecting to the Internet and including an input device capable of reading information from a consumer's financial payment card. In some embodiments, the POS terminal **32** may be a consumer's personal computer, such as when conducting an online purchase through the Internet. As used herein, the terms POS device, POS terminal, and point of interaction device are used broadly, generally, and interchangeably to refer to any device with which the consumer **22** interacts to complete a digital wallet transaction.

A database server **36** is connected to the database **26**, which is configured to store information on a variety of matters, including, for example, biometric data, consumer profiles/accounts, tokenization data corresponding to the consumer **22**, identification data associated with the consumer computing device **40**, and the like, as is described herein in greater detail. In one embodiment, the database **26** is a centralized database stored on the server system **30**. The database **26** may be accessed by potential users at one of the client systems **34** by logging onto the server system **30** through one of the client systems **34**. In an alternative embodiment, the database **26** is stored remotely from the server system **30** and may be a distributed or non-centralized database.

In one example embodiment, the database **26** may include a single database having separated sections or partitions or may include multiple databases, each being separate from each other. The database **26** may store transaction data generated as part of sales activities conducted over the processing network, including data relating to merchants, account holders or customers, issuers, acquirers, savings amounts, savings account information, and/or purchases made. The database **26** may also store account data including at least one of a consumer name, a consumer address, an account number, and other account identifiers that relate the consumer computing device **40** to the consumer **22**. The database **26** may also store merchant data including a merchant identifier that identifies each merchant registered to use the network, and instructions for authenticating consumers and performing and settling transactions, including merchant bank account information. The database **26** may also store authorization request data and tokenization request data.

In the exemplary embodiment, one of the client systems **34** may be associated with the acquirer **14** (shown in FIG. **1**) while another one of the client systems **34** may be associated with the issuer **18** (shown in FIG. **1**). The POS terminal **32** may be associated with the merchant **12** (shown in FIG. **1**) or may be a computer system and/or mobile computing system used by a cardholder (e.g., the consumer **22** (shown in FIG. **1**)) making an on-line purchase or payment. The server system **30** may be associated with the interchange network **16** or another payment processor. In the example embodiment, the server system **30** is associated with a financial transaction processing network, such as the interchange network **16**, and may be referred to as an interchange computer system. The server system **30** may be used for processing tokenization and transaction data. In addition, the client systems **34** and the POS terminals **32** may include a computer system associated with at least one of a merchant, an online bank, a bill payment outsourcer, an acquirer bank, an acquirer processor, an issuer bank associated with a payment card, an issuer processor, a remote payment processing system, a third-party aggregator, and/or a biller.

In the example embodiment, the processing system **200** is in communication with the consumer authentication computing system **46**, which may be associated with the interchange network **16** or with an outside third party in a contractual relationship with the interchange network **16**. In some embodiments, the consumer authentication computing system **46** is in communication with the server system **30** and may be a component of the server system **30** or a separate computing device. In the example embodiment, the consumer authentication computing system **46** processes transaction requests and authenticates a consumer based on biometric data and a unique identifier (UID) associated with a facial covering **24** of the consumer. As such, the consumer authentication computing system **46** is configured to receive/provide various data from/to one or more parties involved in the authentication request. It is noted that the payment network **10** may include more, fewer, or alternative components and/or perform more, fewer, or alternative actions, including those discussed elsewhere herein.

Furthermore, in an example embodiment, the processing system **200** is in communication with the token service system **28**, which may be associated with the interchange network **16** or with an outside third party in a contractual relationship with the interchange network **16**. In some embodiments, the token service system **28** is in communication with the server system **30** and may be a component of the server system **30** or a separate computing device. In the example embodiment, the token service system **28** processes tokenization requests and assigns payment tokens, such as the payment token **44** (shown in FIG. **1**) to contactless payment devices, such as the consumer computing device

40, and as such, is configured to provide various transaction information to one or more parties involved in the tokenization request, such as the card issuer **18** and the consumer **22**. It is noted that the payment network **10** may include more, fewer, or alternative components and/or perform more, fewer, or alternative actions, including those discussed elsewhere herein.

Face Covering

FIG. **3** is a schematic perspective view of the face covering **24**. In the exemplary embodiment, the face covering **24** includes an integrated circuit (IC) or micromodule, such as the electronic circuit device **38**, that stores and transmits data between electronic devices. In the exemplary embodiment, the electronic circuit device **38** is a wireless communication module that includes, for example, one or more of a Bluetooth, NRC, RFID, infra-red Wireless, Induction Wireless, WLAN, or Ultra-Wideband transmitter or transceiver. Preferably, the electronic circuit device **38** is configured to wirelessly communicate with the consumer computing device **40**, for example, to transmit a unique identifier (UID) thereto.

The face covering **24** can include any type of face covering, such as, without limitation, a basic cloth mask, a disposable mask, a surgical mask, an N95 or KN95 respirator, a gaiter, and the like. In the example embodiment, the face covering **24** is depicted as a typical disposable surgical mask. The face covering **24** includes a central body portion **48** that is preferably of generally elliptical shape instead of rectangular form to provide a convenient and comfortable form fitting mask. The generally elliptical form facilitates fitting a user's face such that the face covering **24** substantially covers the user's nose and mouth. The example face covering **24** also includes a pair of elastic loops **50** for convenient application about the user's ears, which results in the face covering **24** being readily applied or removed as desired.

In the example embodiment, the electronic circuit device **38** is removably attached to the face covering **24**. For example, and without limitation, the electronic circuit device **38** may be placed in a pocket formed on the face covering **24**. This allows the electronic circuit device **38** to be removed from the face covering **24** such that the electronic circuit device **38** can be used with disposable and/or washable face coverings. Furthermore, removing the electronic circuit device **38** facilitates replacing a power source (e.g., a battery) of the electronic circuit device **38**. In some embodiments, the electronic circuit device **38** may take the form of a sticker that may be adhered to the face covering **24**, for example, if there is no pocket available for securing the electronic circuit device **38**.

As depicted in FIG. **3**, the electronic circuit device **38** includes a body **52** that may be generally planar and rectangular in shape. The body **52** may be formed of one or more layers of material, such as plastic sheet, paper, and the like. The one or more layers of material may be rigid or flexible. In some embodiments, an adhesive layer (not shown) may be provided on a surface of the body **52**. A wireless transmitter chip **54** (e.g., an integrated circuit or IC) is embedded in the body **52**. An antenna **56** is embedded in the body **52** and extends generally along a periphery of the body **52** to generally form a loop. The antenna **56** is coupled to the wireless transmitter chip **54** and is configured to transmit radio signals when current flows through the looped wire. For example, the antenna **56** allows the wireless transmitter chip **54** to transmit a unique identifier (UID), code, and/or electronic message (broadly "data"), stored in the wireless transmitter chip **54**, to another electronic device, such as the consumer computing device **40**. Moreover, the electronic circuit device **38** optionally includes an internal power supply (e.g., a battery or other self-contained power source) to provide power to the wireless transmitter chip **54**.

For purposes of illustration, the wireless transmitter chip **54** and antenna **56** are depicted in FIG. **3**, but in practical examples of the electronic circuit device **38** the body **52** may be formed largely of opaque plastic and/or paper and the wireless transmitter chip **54** and antenna **56** may be embedded in the opaque plastic and/or paper so as not to be visible.

Exemplary Computer Systems

FIG. **4** is an example configuration of a user computing system **400**, such as the consumer computing device **40** (shown in FIG. **1**), that may be operated by a user, such as the consumer **22** (shown in FIG. **1**). In the exemplary embodiment, the computing system **400** is a computing device configured to connect to one or more of the merchant **12**, the interchange network **16**, the issuer **18**, the network **20**, a POS terminal **32**, the electronic circuit device **38**, and any other computing devices, such as other consumer computing devices (not shown).

In the exemplary embodiment, the computing system **400** generally includes a processor **406**, a memory device **412**, a transceiver **418** (or a wireless communication device), and a photographic element **424**. In addition, the computing system **400** includes an integrated Wi-Fi component **402** (e.g., implementing the Institute of Electrical and Electronics/IEEE 802.11 family of standards), an input device **404**, a display **420**, and an audio module **422**. Moreover, the computing system **400** optionally includes an internal power supply **410** (e.g., a battery or other self-contained power source) to receive power, or alternatively, in some embodiments, the computing system **400** may include an external power source **408**. Optionally, the computing system **400** may include a motion sensor **438**.

The processor **406** includes one or more processing units (e.g., in a multi-core configuration) specially programmed for executing computer readable instructions. The instructions may be executed within a variety of different operating systems (OS) on the consumer computing device **40**, such as UNIX, LINUX, Microsoft Windows®, etc. More specifically, the instructions may cause various data manipulations on data stored in the memory device **412** (e.g., create, read, update, and delete procedures). It should also be appreciated that upon initiation of a computer-based method, various instructions may be executed during initialization. Some operations may be required to perform one or more processes described herein, while other operations may be more general and/or specific to a programming language (e.g., C, C#, C++, Java, or other suitable programming languages, etc.). The memory device **412** is any device allowing information such as digital wallet data **426**, the executable instructions, and/or written works to be stored and retrieved. The memory device **412** includes one or more computer readable media.

In the example embodiment, the processor **406** may be implemented as one or more cryptographic processors. A cryptographic processor may include, for example, dedicated circuitry and hardware such as one or more cryptographic arithmetic logic units (not shown) that are optimized to perform computationally intensive cryptographic functions. A cryptographic processor may be a dedicated microprocessor for carrying out cryptographic operations, embedded in a packaging with multiple physical security measures, which facilitate providing a degree of tamper resistance. A cryptographic processor facilitates providing a tamper-proof boot and/or operating environment, and persistent and volatile storage encryption to facilitate secure, encrypted transactions.

Because the computing system **400** may be widely deployed, it may be impractical to manually update software for each computing system **400**. Therefore, the network system **100** provides a mechanism for automatically updating the software on the computing system **400**. For example, an updating mechanism may be used to automatically update any number of components and their drivers, both network and non-network components, including system level (OS) software components. In some embodiments, the computing system **400** components are dynamically loadable and unloadable; thus, they may be replaced in operation without having to reboot the OS.

A location of the computing system **400** can be obtained through conventional methods, such as a location service (e.g., global positioning system (GPS) service) in the computing system **400**, "ping" data that includes geotemporal data, from cell location register information held by a telecommunications provider to which the computing system **400** is connected, and the like. For example, in one suitable embodiment, an optional GPS chip **428** can be part of or separate from the processor **406** to enable the location of the computing system **400** to be determined.

Stored in the memory device **412** are, for example, computer readable instructions for providing a user interface to the user via the display **420** and, optionally, receiving and processing input from the input device **404**. A user interface may include, among other possibilities, a web browser and the digital wallet application **42** (shown in FIG. **1**). Web browsers enable users, such as the consumer **22**, to display and interact with media and other information typically embedded on a web page or a website. The digital wallet application **42** allows the consumer **22** to interact, for example, with a POS terminal **32** and/or the merchant **12** to perform electronic transactions.

The photographic element **424** may include a camera or other optical sensor and lens combination capable of generating a video signal and capturing an image, iris scan, and the like. In various embodiments, the photographic element **424** may be integrated in a housing or body, such as a housing **414**, of the computing system **400**. When the photographic element **424** captures an image or otherwise generates image data (e.g., video data), the photographic element **424** may store the image data in a data file, either in a raw or compressed format, in the memory device **412**.

In some embodiments, the motion sensor **438** may include one or more sensor elements that facilitate detecting a person's presence. For example, if the computing system **400** is operating as the consumer computing device **40**, the motion sensor **438** detects when the consumer **22** moves or raises the consumer computing device **40**. Upon detection of such motion, the photographic element **424** may begin capturing images (e.g., still or video images), the transceiver **418** may be activated, and/or the audio module **422** may begin capturing audio. The motion sensor **438** may be operatively coupled to the photographic element **424** such that the consumer's presence may be detected by detecting motion using the photographic element **424**. The motion sensor **438** may include, for example, and without limitation, sensor elements such as a passive infrared sensor, an ambient light sensor, and the like.

In the example embodiment, the display **420** can include, for example, and without limitation, a liquid crystal display (LCD), an organic light emitting diode (OLED) display, or an "electronic ink" display. In some embodiments, a single component such as a touch screen may function as both an output device (e.g., the display **420**) and the input device **404**. As such, the display **420** may optionally include a touch controller for support of touch capability. In such embodiments, the computing system **400** may detect a user's presence by detecting that the user has touched the display **420** of the computing system **400**.

The audio module **422** may include, for example, and without limitation, a speaker and related components capable of broadcasting streaming and/or recorded audio and may also include a microphone. The microphone facilitates capturing audio through the computing system **400**.

In the example embodiment, the computing system **400** includes the housing **414** at least partly (and more preferably, at least substantially or entirely) enclosing the components described above. In addition, the computing system **400** includes circuitry **430** configured to communicate with the network **20** (shown in FIG. **1**) and/or other computing devices (e.g., other user computing devices, the POS terminal **32**, the interchange network **16**, etc.). The circuitry **430** may include, for example, leads, connectors, NFC-enabled circuitry, Wi-Fi-enabled circuitry, and photographic element circuitry. The housing **414** is preferably configured to seal the circuitry **430**, which is susceptible to degradation from the ambient environment. In one embodiment, the circuitry **430** is hermetically sealed in the housing **414**. For example, in one embodiment, the circuitry **430** is completely and permanently encased within the housing **414**. In other words, the housing **414** and the circuitry **430** are intended to remain as a single, inseparable unit throughout the life of the consumer computing device **40**. It is understood that the housing **414** can be formed separately from the circuitry **430** and that the circuitry **430** can be placed into and sealed within the housing **414** in a separate operation. It is also understood that the housing **414** can be oversized with respect to the circuitry **430** so that the circuitry **430** can be placed loosely into the housing **414**. In another embodiment, the circuitry **430** can be selectively, sealingly enclosed within the housing **414**, where the housing **414** includes a closure **416** removably attached to a body of the housing **414**.

The housing **414** is fabricated from a suitably selected material that facilitates inhibiting the effect the material has on the signal being emitted from, for example, the transceiver **418** and/or the Wi-Fi component **402** and passing through the housing material. For example, and without limitation, suitable materials from which the housing **414** may be fabricated include polyethylene, propylene, isoprene, and butylenes (i.e., polyolefins). In other embodiments, the housing **414** is fabricated from any material that enables the computing system **400** to function as described herein, such as metals, etc.

In one embodiment, the transceiver **418** includes an antenna **432**. The antenna **432** includes a looped wire configured to transmit radio signals when current flows through the looped wire. The antenna **432** is any size, shape, and configuration that is suitable for transmitting signals as described herein. For example, the antenna **432** is a tuned circuit configured to transmit radio signals in any radio-based communication system including, but not limited to, Radio Frequency Identification (RFID), Wireless Local Area Network (WLAN), and Wireless Personal Area Network (WPAN) systems. In the example embodiment, the antenna **432** generates a magnetic field when it vibrates at a selected frequency. Specifically, the antenna **432** is configured to vibrate at a frequency of about 13.56 MHz, which is suitable for use in a near field communication (NFC) system.

In the example embodiment, the antenna **432** transmits radio signals to and receives radio signals from other wireless-enabled computing devices, for example, another user computing device, merchant POS terminals **32**, the electronic circuit device **38**, and/or any other components used in wireless systems. In NFC systems, for example, at least one NFC component generates a magnetic field to inductively transfer currents and, thereby, exchange signals and information with other NFC components positioned within the magnetic field. In one example embodiment, the antenna **432** functions as an NFC component to send and receive signals. The antenna **432** is configured to transmit radio signals to NFC components positioned within the magnetic field of the antenna **432**, such as when the consumer computing device **40** is located within a predetermined distance of the electronic circuit device **38**. Therefore, the magnetic field generated by the antenna **432** defines the active range of the computing system **400**. Additionally, the antenna **432** receives radio signals from NFC components when the antenna **432** is positioned within the magnetic field of the NFC components.

The transceiver **418** also includes a radio frequency (RF) interface **434** and an NFC device controller **436**. The RF interface **434** and the NFC device controller **436** are powered by the power source **408**, and in some embodiments, the internal power supply **410**. In addition, the processor **406** and the memory device **412** are powered in the same manner. The RF interface **434** is configured to receive and transmit RF signals through the antenna **432**. The NFC device controller **436** is configured to process the received RF signals and to generate signals to be transmitted by the RF interface **434**. The memory device **412** is configured to store data associated with transmitting and receiving the RF signals. The NFC device controller **436** is coupled in communication with the processor **406**.

In some embodiments, the computing system **400** may be connected to one or more peripheral devices (not shown). That is, the computing system **400** may communicate various data with one or more peripheral devices. For example, the computing system **400** may communicate with one or more peripheral devices through the Wi-Fi component **402**, the transceiver **418**, or other suitable means.

FIG. **5** is an example configuration of a computing system **500** operated by a user **501**. In some embodiments, the computing system **500** is a merchant POS terminal **32**, a client system **34**, and/or a contactless ATM, for example. In the example embodiment, the computing system **500** includes a processor **502** for executing instructions. In some embodiments, executable instructions are stored in a memory device **504**. The processor **502** includes one or more processing units, for example in a multi-core processor configuration. The memory device **504** is any device allowing information such as executable instructions and/or written works to be stored and retrieved. The memory device **504** includes one or more computer readable media.

In the example embodiment, the processor **502** may be implemented as one or more cryptographic processors. A cryptographic processor may include, for example, dedicated circuitry and hardware such as one or more cryptographic arithmetic logic units (not shown) that are optimized to perform computationally intensive cryptographic functions. A cryptographic processor may be a dedicated microprocessor for carrying out cryptographic operations, embedded in a packaging with multiple physical security measures, which facilitate providing a degree of tamper resistance. A cryptographic processor facilitates providing a tamper-proof boot and/or operating environment, and persistent and volatile storage encryption to facilitate secure, encrypted transactions.

Because the computing system **500** may be widely deployed, it may be impractical to manually update software for each computing system **500**. Therefore, the system **10** may, in some embodiments, provide a mechanism for automatically updating the software on the computing system **500**. For example, an updating mechanism may be used to automatically update any number of components and their drivers, both network and non-network components, including system level (OS) software components. In some embodiments, the computing system **500** components are dynamically loadable and unloadable; thus, they may be replaced in operation without having to reboot the OS.

The computing system **500** also includes at least one media output component **506** for presenting information to the user **501**. The media output component **506** is any component capable of conveying information to the user **501**. In some embodiments, the media output component **506** includes an output adapter such as a video adapter and/or an audio adapter. An output adapter is operatively coupled to the processor **502** and operatively connectable to an output device such as a display device, for example, and without limitation, a liquid crystal display (LCD), organic light emitting diode (OLED) display, or "electronic ink" display, or an audio output device such as a speaker or headphones.

In some embodiments, the computing system **500** includes an input device **508** for receiving input from the user **501**. The input device **508** may include, for example, one or more of a touch sensitive panel, a touch pad, a touch screen, a stylus, a position detector, a keyboard, a pointing device, a mouse, and an audio input device. A single component such as a touch screen may function as both an output device of the media output component **506** and the input device **508**.

The computing system **500** may also include a communication interface **510**, which is communicatively connectable to a remote device such as the server system **30** (shown in FIG. **2**), the consumer computing device **40**, and/or the face covering **24**. The communication interface **510** may include, for example, a wired or wireless network adapter or a wireless data transceiver for use with Bluetooth communication, radio frequency (RF) communication, near field communication (NFC), and/or with a mobile phone network, Global System for Mobile communications (GSM), 3G, or other mobile data network, and/or Worldwide Interoperability for Microwave Access (WiMax) and the like.

Stored in the memory device **504** are, for example, computer readable instructions for providing a user interface to the user **501** via the media output component **506** and, optionally, receiving and processing input from the input device **508**. A user interface may include, among other possibilities, a web browser and a client application. Web browsers enable users, such as the user **501**, to display and interact with media and other information typically embedded on a web page or a website from the server system **30**. A client application allows the user **501** to interact with a server application associated with a merchant.

FIG. **6** is an example configuration of a server system **600**, such as the server system **30** (shown in FIG. **2**). The server system **600** includes, but is not limited to, the transaction database **26** (shown in FIG. **1**), the token service system **28** (shown in FIG. **1**), and the consumer authentication computing system **46** (shown in FIG. **1**). In the example embodiment, the server system **600** includes a processor **602** for executing instructions. The instructions may be stored in a memory area **604**, for example. The processor **602** includes one or more processing units (e.g., in a multi-core configuration) for executing the instructions. The instructions may be executed within a variety of different operating systems on the server system **600**, such as UNIX, LINUX, Microsoft Windows®, etc. More specifically, the instructions may cause various data manipulations on data stored in a storage device **610** (e.g., create, read, update, and delete procedures). It should also be appreciated that upon initiation of a computer-based method, various instructions may be executed during initialization. Some operations may be required to perform one or more processes described herein, while other operations may be more general and/or specific to a programming language (e.g., C, C#, C++, Java, or other suitable programming languages, etc.). In the example embodiment, the processor **602** may be implemented as one or more cryptographic processors, as described above with respect to the user system **600**.

The processor **602** is operatively coupled to a communication interface **606** such that the server system **600** can communicate with a remote device such as a computing system **500** (shown in FIG. **5**) or another server system. For example, the communication interface **606** may receive communications from a POS terminal **32**, a client system **34**, and/or a consumer computing device **40** via the Internet, as illustrated in FIG. **2**.

The processor **602** is operatively coupled to the storage device **610**. The storage device **610** is any computer-operated hardware suitable for storing and/or retrieving data. In some embodiments, the storage device **610** is integrated in the server system **600**. In other embodiments, the storage device **610** is external to the server system **600** and is similar to the transaction database **26**. For example, the server system **600** may include one or more hard disk drives as the storage device **610**. In other embodiments, the storage device **610** is external to the server system **600** and may be accessed by a plurality of server systems **600**. For example, the storage device **610** may include multiple storage units such as hard disks or solid-state disks in a redundant array of inexpensive disks (RAID) configuration. The storage device **610** may include a storage area network (SAN) and/or a network attached storage (NAS) system.

In some embodiments, the processor **602** is operatively coupled to the storage device **610** via a storage interface **608**. The storage interface **608** is any component capable of providing the processor **602** with access to the storage device **610**. The storage interface **608** may include, for example, an Advanced Technology Attachment (ATA) adapter, a Serial ATA (SATA) adapter, a Small Computer System Interface (SCSI) adapter, a RAID controller, a SAN adapter, a network adapter, and/or any component providing the processor **602** with access to the storage device **610**.

The memory area **604** includes, but is not limited to, random access memory (RAM) such as dynamic RAM (DRAM) or static RAM (SRAM), read-only memory (ROM), erasable programmable read-only memory (EPROM), electrically erasable programmable read-only memory (EEPROM), and non-volatile RAM (NVRAM). The above memory types are exemplary only and are thus not limiting as to the types of memory usable for storage of a computer program.

Consumer Authentication System

FIG. **7** is a schematic diagram showing operation of a consumer authentication system **700**. As described herein, the consumer authentication computing system **46** is configured to receive requests from a consumer **702** to prevent processing of transactions against the consumer's PAN **720** without first obtaining real-time authentication of the consumer. In some embodiments, the consumer authentication computing system **46** is also in communication with a merchant system, an issuer system, and/or the POS terminal **32** of the merchant **12**. In the example embodiment, the consumer authentication computing system **46** is a component of a payment card network, such as payment card interchange network **16**.

In the example embodiment, the consumer authentication computing system **46** is programmed to communicate with one or more consumer computing devices **40**, via the digital wallet application **42**, to receive account registration information **706** to facilitate establishing a consumer account that is not previously registered with the consumer authentication computing system **46**. In particular, the account registration process creates a consumer account and associated credentials for use with the consumer authentication computing system **46** and/or the digital wallet application **42**. In the exemplary embodiment, the consumer **702** enters the account registration information **706** for transmission to the consumer authentication computing system **46**. The account registration information **706** may include, for example, and without limitation, payment account data (e.g., the PAN, a virtual payment number, limited use number, etc.), identification data of the consumer computing device **40** (e.g., an Electronic Serial Number (ESN), Mobile Equipment Identifier (MEID), International Mobile Equipment Identity (EVIEI) number, and the like), biometric data of the consumer **702**, and/or contact information, as described herein. The account registration information **706** may be linked and stored in the database **26**. The consumer authentication computing system **46** generates a consumer profile (or account) **708** from the account registration information **706** for the consumer **702**.

Furthermore, in the example embodiment, the consumer authentication computing system **46** is programmed to receive a biometric profile **710** from a biometrics module **712**. The biometric profile **710** may include, for example, biometric data or biometrics of the consumer **702**, i.e., one or more scans or digital representations **714** of select physical features of the consumer **702** that are to be validated during account setup and/or authentication requests for transactions against the consumer's PAN **720**. As described herein, the biometrics or physical features of the consumer **702** can include, for example, and without limitation, facial features, iris features, vein patterns, and the like. The biometric profile **710** may be stored, for example, in the biometrics module **712** or the database **26**. The consumer authentication computing system **46** supplements the consumer account **708** with the biometric profile **710**. The biometrics module **712** is programmed to receive the one or more scans or digital representations **714** of physical features from the consumer's computing device **40** and use the scans or digital representations to generate the biometric profile **710** and/or validate one or more scans or digital representations **714** against the biometric profile **710**. For example, the consumer authentication computing system **46**, using the biometrics module **712**, is configured to search a plurality of biometric identifiers for at least a partial match to the received biometric data. This partial match (e.g., using facial recognition processes) enables a user to be at least partly identified without a need to remove a face covering, such as the face covering **24**. The consumer authentication computing system **46** determines whether to approve or deny the transaction based, at least in part on, on whether or not a match or partial match is found.

In the example embodiment, the consumer authentication computing system **46** is also programmed to receive the unique identifier (UID) **716**, wirelessly, from the electronic circuit device **38** attached to the face covering **24** (shown in FIG. **1**) and/or from the consumer **702** as part of the registration information. The unique identifier (UID) **716** facilitates authenticating the consumer **702** when the biometric data (i.e., the one or more scans or digital representations **714**) indicates a potential match (e.g., a partial match), but the matching data falls below a predetermined upper threshold amount but above a predetermined lower threshold amount (i.e., within a predetermined threshold range). The consumer authentication computing system **46** supplements the consumer account **708** with the unique identifier (UID) **716**.

In the exemplary embodiment, the consumer authentication computing system **46** communicates with the digital wallet application **42** to send, receive, and store information related to, for example, and without limitation, authentication of transactions against the consumer's PAN **720**, notifications **718** of transactions made against the consumer's PAN **720**, etc. When a consumer selects to perform a transaction, for example, with the consumer's PAN **720**, at a POS terminal **32**, the transaction is not allowed to proceed until the customer is authenticated. The digital wallet application **42** may require biometric data of the consumer to be validated before executing a transaction with the payment token **44**.

In some embodiments, the consumer authentication computing system **46** may send notifications **718** to the consumer **702**, for example, via the digital wallet application **42**. The notifications **718** may concern transaction attempts made against the consumer's PAN **720**. In the exemplary embodiment, the notifications **718** include information about the attempted transaction, including, for example, and without limitation, the merchant's name, the merchant's location, the transaction amount, combinations thereof, or other information. The notification may also include an authentication request message asking the consumer **702** to provide authentication of the transaction or to decline the transaction. For example, the digital wallet application **42** may request that the consumer **702** provide, for example, one or more scans or digital representations **714** of physical features of the consumer **702**, such as facial or iris scans, to the consumer authentication computing system **46** via the consumer computing device **40** to facilitate authentication of the consumer for processing the transaction.

Exemplary Computer-Implemented Methods

FIGS. **8**A and **8**B depict a flow diagram of an example method **800** for registering and authenticating a consumer **702** (such as the consumer **22** shown in FIG. **1**), for example, during a transaction using the consumer computing device **40**, in accordance with one embodiment of the present disclosure. The operations described herein may be performed in the order shown in FIGS. **8**A and **8**B or, according to certain inventive aspects, may be performed in a different order. Furthermore, some operations may be performed concurrently as opposed to sequentially, and/or some operations may be optional, unless expressly stated otherwise or as may be readily understood by one of ordinary skill in the art.

The computer-implemented method **800** is described below, for ease of reference, as being executed by exemplary devices and components introduced with the embodiments illustrated in FIGS. **1**-**7**. In one embodiment, the computer-implemented method **800** is implemented by the consumer authentication computing system **46** (shown in FIG. **1**). In the exemplary embodiment, the computer-implemented method **800** relates to authenticating a consumer performing a contactless transaction using partial facial recognition and a unique identifier (UID) attached to a face covering. While operations within the computer-implemented method **800** are described below regarding the consumer authentication computing system **46**, according to some aspects of the present invention, the computer-implemented method **800** may be implemented using any other computing devices and/or systems through the utilization of processors, transceivers, hardware, software, firmware, or combinations thereof. A person having ordinary skill will also appreciate that responsibility for all or some of such actions may be distributed differently among such devices or other computing devices without departing from the spirit of the present disclosure.

One or more computer-readable medium(s) may also be provided. The computer-readable medium(s) may include one or more executable programs stored thereon, wherein the program(s) instruct one or more processors or processing units to perform all or certain of the steps outlined herein. The program(s) stored on the computer-readable medium(s) may instruct the processor or processing units to perform additional, fewer, or alternative actions, including those discussed elsewhere herein.

In the exemplary embodiment, the method **800** includes the consumer authentication computing system **46** receiving, at operation **802**, an enrollment request message including registration information from the consumer **702** (shown in FIG. **7**). The registration information includes at least non-biometric identification information (e.g., a name, an address, a national identification number, etc.) and contact information (e.g., a mobile telephone number, an e-mail address, a social media account username, etc.). Further, the consumer authentication computing system **46** prompts, via a push notification, the consumer **702** to input biometric information (i.e., the one or more scans or digital representations **714** of physical features of the consumer) captured by the consumer computing device **40**, and more particularly, the photographic element of the consumer computing device **40** (e.g., the photographic element **424**). The consumer computing device **40** transmits the captured one or more scans or digital representations **714** to the consumer authentication computing system **46**, which receives the information along with the enrollment request. In response to receiving the enrollment request and the registration information, at operation **804** the consumer authentication computing system **46** generates the consumer account **708** (shown in FIG. **7**) for the requesting consumer on the database **26**, for example. The consumer authentication computing system **46** enrolls the consumer **702** for future transactions.

During a digital wallet transaction by the consumer **702**, at operation **806** the consumer authentication computing system **46** receives a transaction request message from the consumer **702**. For example, the consumer **702** transmits a transaction request message to the consumer authentication computing system **46** from the consumer computing device **40** via the digital wallet application **42** running thereon. In response, at operation **808**, the consumer authentication computing system **46** transmits (e.g., via push notification to the digital wallet application **42**) an authentication request message to the consumer computing device **40**. The authentication request message causes the digital wallet application **42** running on the consumer computing device **40** to display a notification that the authentication request message is received and to prompt or instruct the consumer **702** to enter or capture one or more scans or digital representations **714** of physical features of the consumer (i.e., biometric identification information or biometric sample). The one or more scans or digital representations **714** are transmitted to the biometrics module **712** of the consumer authentication computing system **46**. In the exemplary embodiment, the biometric sample includes image data of the consumer's face for use in a facial recognition process. In certain embodiments, the biometric sample may include iris scans, vein pattern data, and/or any other digital representation of a biometric feature of the consumer that enables the consumer authentication computing system **46** to function as described herein.

At operation **810**, the consumer authentication computing system **46** receives an authentication response message including the biometric sample, i.e., the captured one or more scans or digital representations **714**, from the consumer computing device **40**. At operation **812**, the consumer authentication computing system **46** retrieves the biometric profile **710** (i.e., sample biometric information) corresponding to the consumer **702** from the database **26** and/or the biometrics module **712**. In some embodiments, the database **26** may be a database maintained by a government or government agency that includes identity information forming a portion of a national identification system. For example, the identification database may a database including identification information such as name, address, biometric information (e.g., a facial and/or iris scan), telephone number, a national identification number, and/or other identifying information. In some embodiments, the consumer authentication computing system **46** retrieves the biometric profile **710** by making a call to the database **26**. For example, in one embodiment, the consumer authentication computing system **46** makes a web services call using an Extensible Markup Language Remote Procedure Call (XML-RPC). In a web services call, the consumer authentication computing system **46** includes identification information of the consumer **702** such as a name, address, government issued identification number (e.g., a social security number), the captured one or more scans or digital representations **714**, and/or other information. The database **26** and/or biometrics module **712** handling the web service call uses the identification information to identify a corresponding biometric profile **710** stored in the database **26** or biometrics module **712**.

At operation **814**, the consumer authentication computing system **46** compares the biometric profile **710** to the one or more scans or digital representations **714** and determines if there is a match (e.g., a match percentage) above a predetermined lower threshold. For example, the consumer authentication computing system **46** uses pattern-based algorithms or other image processing algorithms to compare an image associated with the captured one or more scans or digital representations **714** (e.g., representations of a face and/or iris) to an image associated with the biometric profile **710** (e.g., data associated with a face and/or iris). The comparison may yield a match percentage, other indicator of the degree to which the one or more scans or digital representations **714** matches the biometric profile **710**, or a probability that the biometric profile **710** and the captured one or more scans or digital representations **714** match. Based on this information, the consumer authentication computing system **46** determines if there is a match between the sample and captured biometric information above a predetermined lower threshold value. As described herein, the consumer **702** may be wearing a face covering **24**. Thus, the captured one or more scans or digital representations **714** of the consumer **702** may match above a predetermined lower threshold value but may fall short of authenticating the consumer **702** (e.g., being above a predetermined upper threshold value).

In response to a determination that there is not a match above the predetermined lower threshold value, the consumer authentication computing system **46** denies the transaction request at operation **816**. The consumer authentication computing system **46** may also transmit a notification to the consumer **702**, via the consumer computing device **40**, indicating that the transaction request has been denied. For example, the consumer authentication computing system **46** transmits an instruction to the consumer computing device **40** that causes the digital wallet application **42** running thereon to display the notification.

In response to a determination that the match is above the predetermined lower threshold value and below the predetermined upper threshold value, the consumer authentication computing system **46** attempts to establish a wireless connection to the electronic circuit device **38** attached to the face covering **24** at operation **818**. If the connection cannot be established, the consumer authentication computing system **46** denies the transaction request at operation **820**. Upon a successful connection, the consumer authentication computing system **46** reads, or otherwise receives, the unique identifier (UID) **716** from the electronic circuit device **38** at operation **822**.

At operation **824**, the consumer authentication computing system **46** compares the received unique identifier (UID) **716** to the consumer account **708** and determines if the received unique identifier (UID) **716** matches the unique identifier (UID) stored in the consumer account **708**. In particular, the consumer authentication computing system **46** retrieves the unique identifier (UID) stored in the consumer account **708** and compares it to the received unique identifier (UID) **716**. In response to a determination that there is not a match, the consumer authentication computing system **46** denies the transaction request at operation **826**. The consumer authentication computing system **46** may also transmit a notification to the consumer **702**, as described above.

In response to a determination that there is a match, the consumer authentication computing system **46** authorizes the transaction request at operation **828**. The consumer authentication computing system **46** authorizes transaction requests by, for example, allowing the digital wallet application to transmit the payment token **44** to the merchant POS terminal **32** for processing the transaction with the interchange network **16**.

In some embodiments, the consumer authentication computing system **46** transmits a notification of authentication to the consumer **702** at operation **830**. For example, the consumer authentication computing system **46** transmits an instruction to the consumer computing device **40** that is formatted to cause the digital wallet application **42** running thereon to display a notification. The notification may indicate that the consumer has been authenticated via facial/iris recognition and the unique identifier (UID) **716** by consumer authentication computing system **46** such that the transaction can been processed by the merchant.

In certain embodiments, the consumer authentication computing system **46** may receive a geolocation from the GPS chip **428** of the consumer computing device to identify locations that may have implemented mask mandates. In such instances, the consumer authentication computing system **46** may present an alert notification to the consumer **702**, for example, via push notification to the consumer computing device **40** indicating that a mask mandate is in place in the consumer's current location. If the consumer resides or is otherwise located in an area affected by the mask mandate, the alert may be triggered automatically.

As described herein, mask mandates make it difficult to perform payment transactions using digital wallets stored on devices that use facial recognition to authenticate a user. Thus, to perform such digital wallet transactions, a user needs to remove their face mask or input a code, such as a user PIN. Entering a code or PIN can be difficult in situations where a consumer has one or more items in theirs hands. Further, there is a health risk to users that may remove their face mask to allow the device to perform traditional facial recognition. Advantages of the consumer authentication system described herein include authenticating a consumer using partial facial recognition along with a unique identifier that may be received by the consumer's computing device. The unique identifier is associated with the consumer and may be transmitted to the consumer's computing device via wireless technology. A circuit device having the unique identifier stored thereon may be attached, for example, to the face mask of the consumer. As such, the authentication system described herein allows wireless digital wallet transactions without the removal of a consumer's face mask.

ADDITIONAL CONSIDERATIONS

In this description, references to "one embodiment," "an embodiment," or "embodiments" mean that the feature or features being referred to are included in at least one embodiment of the technology. Separate references to "one embodiment," "an embodiment," or "embodiments" in this description do not necessarily refer to the same embodiment and are also not mutually exclusive unless so stated and/or except as will be readily apparent to those skilled in the art from the description. For example, a feature, structure, act, etc. described in one embodiment may also be included in other embodiments but is not necessarily included. Thus, the current technology can include a variety of combinations and/or integrations of the embodiments described herein.

Although the present application sets forth a detailed description of numerous different embodiments, it should be understood that the legal scope of the description is defined by the words of the claims and equivalent language. The detailed description is to be construed as exemplary only and does not describe every possible embodiment because describing every possible embodiment would be impractical. Numerous alternative embodiments may be implemented, using either current technology or technology developed after the filing date of this patent, which would still fall within the scope of the claims.

Throughout this specification, plural instances may implement components, operations, or structures described as a single instance. Although individual operations of one or more methods are illustrated and described as separate operations, one or more of the individual operations may be performed concurrently, and nothing requires that the operations be performed in the order recited or illustrated. Structures and functionality presented as separate components in example configurations may be implemented as a combined structure or component. Similarly, structures and functionality presented as a single component may be implemented as separate components. These and other variations, modifications, additions, and improvements fall within the scope of the subject matter herein. The foregoing statements in this paragraph shall apply unless so stated in the description and/or except as will be readily apparent to those skilled in the art from the description.

Certain embodiments are described herein as including logic or a number of routines, subroutines, applications, or instructions. These may constitute either software (e.g., code embodied on a machine-readable medium or in a transmission signal) or hardware. In hardware, the routines, etc., are tangible units capable of performing certain operations and may be configured or arranged in a certain manner. In example embodiments, one or more computer systems (e.g., a standalone, client or server computer system) or one or more hardware modules of a computer system (e.g., a processor or a group of processors) may be configured by software (e.g., an application or application portion) as computer hardware that operates to perform certain operations as described herein.

In various embodiments, computer hardware, such as a processor, may be implemented as special purpose or as general purpose. For example, the processor may comprise dedicated circuitry or logic that is permanently configured, such as an application-specific integrated circuit (ASIC), or indefinitely configured, such as a field-programmable gate array (FPGA), to perform certain operations. The processor may also comprise programmable logic or circuitry (e.g., as encompassed within a general-purpose processor or other programmable processor) that is temporarily configured by software to perform certain operations. It will be appreciated that the decision to implement the processor as special purpose, in dedicated and permanently configured circuitry, or as general purpose (e.g., configured by software) may be driven by cost and time considerations.

Accordingly, the term "processor" or equivalents should be understood to encompass a tangible entity, be that an entity that is physically constructed, permanently configured (e.g., hardwired), or temporarily configured (e.g., programmed) to operate in a certain manner or to perform certain operations described herein. Considering embodiments in which the processor is temporarily configured (e.g., programmed), each of the processors need not be configured or instantiated at any one instance in time. For example, where the processor comprises a general-purpose processor configured using software, the general-purpose processor may be configured as respective different processors at different times. Software may accordingly configure the processor to constitute a particular hardware configuration at one instance of time and to constitute a different hardware configuration at a different instance of time.

Computer hardware components, such as transceiver elements, memory elements, processors, and the like, may provide information to, and receive information from, other computer hardware components. Accordingly, the described computer hardware components may be regarded as being communicatively coupled. Where multiple of such computer hardware components exist contemporaneously, communications may be achieved through signal transmission (e.g., over appropriate circuits and buses) that connect the computer hardware components. In embodiments in which multiple computer hardware components are configured or instantiated at different times, communications between such computer hardware components may be achieved, for example, through the storage and retrieval of information in memory structures to which the multiple computer hardware components have access. For example, one computer hardware component may perform an operation and store the output of that operation in a memory device to which it is communicatively coupled. A further computer hardware component may then, at a later time, access the memory device to retrieve and process the stored output. Computer hardware components may also initiate communications with input or output devices, and may operate on a resource (e.g., a collection of information).

The various operations of example methods described herein may be performed, at least partially, by one or more processors that are temporarily configured (e.g., by software) or permanently configured to perform the relevant operations. Whether temporarily or permanently configured, such processors may constitute processor-implemented modules that operate to perform one or more operations or functions. The modules referred to herein may, in some example embodiments, comprise processor-implemented modules.

Similarly, the methods or routines described herein may be at least partially processor-implemented. For example, at least some of the operations of a method may be performed by one or more processors or processor-implemented hardware modules. The performance of certain of the operations may be distributed among the one or more processors, not only residing within a single machine, but deployed across a number of machines. In some example embodiments, the processors may be located in a single location (e.g., within a home environment, an office environment or as a server farm), while in other embodiments the processors may be distributed across a number of locations.

Unless specifically stated otherwise, discussions herein using words such as "processing," "computing," "calculating," "determining," "presenting," "displaying," or the like may refer to actions or processes of a machine (e.g., a computer with a processor and other computer hardware components) that manipulates or transforms data represented as physical (e.g., electronic, magnetic, or optical) quantities within one or more memories (e.g., volatile memory, non-volatile memory, or a combination thereof), registers, or other machine components that receive, store, transmit, or display information.

As used herein, the terms "comprises," "comprising," "includes," "including," "has," "having" or any other variation thereof, are intended to cover a non-exclusive inclusion. For example, a process, method, article, or apparatus that comprises a list of elements is not necessarily limited to only those elements but may include other elements not expressly listed or inherent to such process, method, article, or apparatus.

Although the disclosure has been described with reference to the embodiments illustrated in the attached figures, it is noted that equivalents may be employed, and substitutions made herein, without departing from the scope of the disclosure as recited in the claims.

Having thus described various embodiments of the disclosure, what is claimed as new and desired to be protected by Letters Patent includes the following:

1. A system comprising:

a consumer computing device associated with a consumer;

a face covering of the consumer, the face covering including:

a central body portion providing a form fitting mask covering a nose and mouth of the consumer;

a pair of elastic loops attached to the central body portion; and

an integrated electronic circuit device, separate from the consumer computing device, removably attached to the central body portion, and comprising a body being substantially formed of an opaque material, the body including an antenna and a wireless transmitter chip embedded into the opaque material, the antenna extending along a periphery of the body forming a loop, the wireless transmitter chip having a unique identifier (UID) stored thereon, the UID being associated with the electronic circuit device; and

a consumer authentication computing system comprising:

a processor; and

a memory storing computer-executable instructions thereon, that when executed by the processor, cause the processor to perform operations of:

receiving account registration information from the consumer computing device associated with the consumer, the account registration information including the unique identifier (UID);

generating a consumer account including the account registration information and the unique identifier (UID);

receiving a biometric profile of the consumer, the biometric profile including a digital representation of a physical feature of the consumer;

storing the generated consumer account and the biometric profile on the memory;

receiving, from the consumer computing device, a transaction request message including a transaction request;

in response to the transaction request, transmitting an authentication request message to the consumer computing device;

receiving an authentication response message from the consumer computing device, the authentication response message including a biometric sample;

determining that the biometric sample matches the biometric profile of the consumer above a predetermined lower threshold value and below a predetermined upper threshold value;

in response to the determination, establishing a wireless connection to the integrated electronic circuit device;

reading, via the wireless connection, the unique identifier (UID) from the electronic circuit device; and

approving the transaction request if the read unique identifier (UID) matches the unique identifier (UID) of the generated consumer account.

2. The system of claim **1**, wherein said operation of receiving account registration information comprises receiving an enrollment request message from the consumer computing device.

3. The system of with claim **1**, the computer-executable instructions, that when executed by the processor, further cause the processor to perform the operation of prompting, via a push notification, the consumer to input the biometric profile via the consumer computing device.

4. The system of with claim **1**, wherein transmitting the authentication request message to the consumer computing device, further comprises pushing the authentication request message to a digital wallet application on the consumer computing device.

5. The system of with claim **4**, said authentication request message comprising an instruction requesting the consumer enter the biometric sample into the consumer computing device.

6. The system of claim **1**, the computer-executable instructions, that when executed by the processor, further cause the processor to perform operations of:

determining the read unique identifier (UID) matches the unique identifier (UID) of the generated consumer account based on comparing the biometric sample to the biometric profile; and

determining a match percentage for the comparison.

7. The system in accordance with claim **1**, the computer-executable instructions, that when executed by the processor, further cause the processor to perform the operation of, in response to the determination, determining that a wireless connection cannot be established to the electronic circuit device.

8. The system in accordance with claim **7**, the computer-executable instructions, that when executed by the processor, further cause the processor to perform the operation of denying the transaction request based on the determination that a wireless connection cannot be established.

9. The system in accordance with claim **1**, wherein determining that the read unique identifier (UID) matches the unique identifier (UID) of the generated consumer account comprises:

retrieving the unique identifier (UID) included in the generated consumer account; and

comparing the read unique identifier (UID) to the retrieved unique identifier (UID) stored in the generated consumer account.

10. The system in accordance with claim **9**, the computer-executable instructions, that when executed by the processor, further cause the processor to perform the operation of:

denying the transaction request, if the read unique identifier (UID) and the retrieved unique identifier (UID) do not match.

11. The system in accordance with claim **1**, the face covering comprising one or more of the following: a cloth mask, a disposable mask, a surgical mask, an N95 respirator, a KN95 respirator, and a gaiter.

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