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**Oakes, III et al.**

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(54) **DIGITAL CAMERA PROCESSING SYSTEM**

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(Continued)

(52) **U.S. Cl.**
CPC ..... ***G06V 30/40*** (2022.01); ***G06Q 20/04*** (2013.01); ***G06Q 20/042*** (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC ..... G06V 30/40; G06V 10/20; G06Q 20/04; G06Q 20/042; G06Q 20/108; G06Q 40/00;
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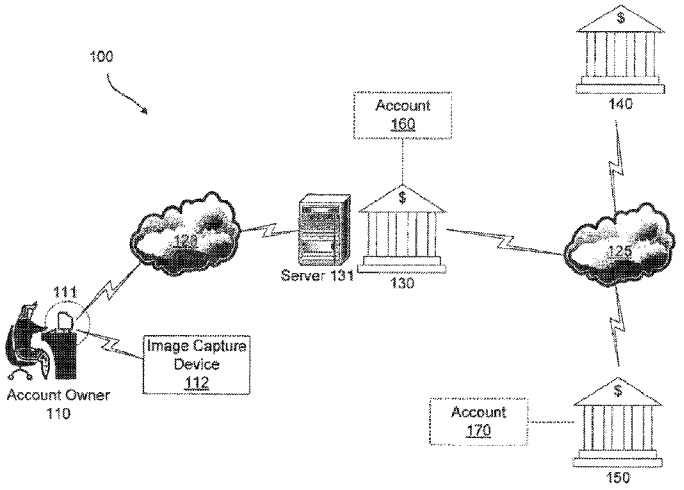
(57) **ABSTRACT**

A digital camera processing system with software to manage taking photos with a digital camera. Camera software controls the digital camera. A downloaded software component controls the digital camera software and causes a handheld mobile device to perform operations. The operations may include instructing a user to have the digital camera take photos of a check; displaying an instruction on a display of the handheld mobile device to assist the user in having the digital camera take the photos; or assisting the user as to an orientation for taking the photos with the digital camera. The digital camera processing system may generate a log file including a bi-tonal image formatted as a TIFF image.

**20 Claims, 6 Drawing Sheets**



**Related U.S. Application Data**

continuation of application No. 16/025,679, filed on Jul. 2, 2018, now Pat. No. 11,023,719, which is a continuation of application No. 15/663,284, filed on Jul. 28, 2017, now Pat. No. 10,013,605, which is a continuation of application No. 14/225,090, filed on Mar. 25, 2014, now abandoned, said application No. 16/025,679 is a continuation of application No. 14/225,090, filed on Mar. 25, 2014, now abandoned, which is a continuation of application No. 11/590,974, filed on Oct. 31, 2006, now Pat. No. 8,708,227.

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(58) **Field of Classification Search**

CPC ..... G06Q 40/02; H04N 1/00204; H04N 1/00244; H04N 1/00307; H04N 1/00816; H04N 1/387; H04N 1/403; H04N 2101/00; H04N 2201/001; G06K 7/10861

See application file for complete search history.

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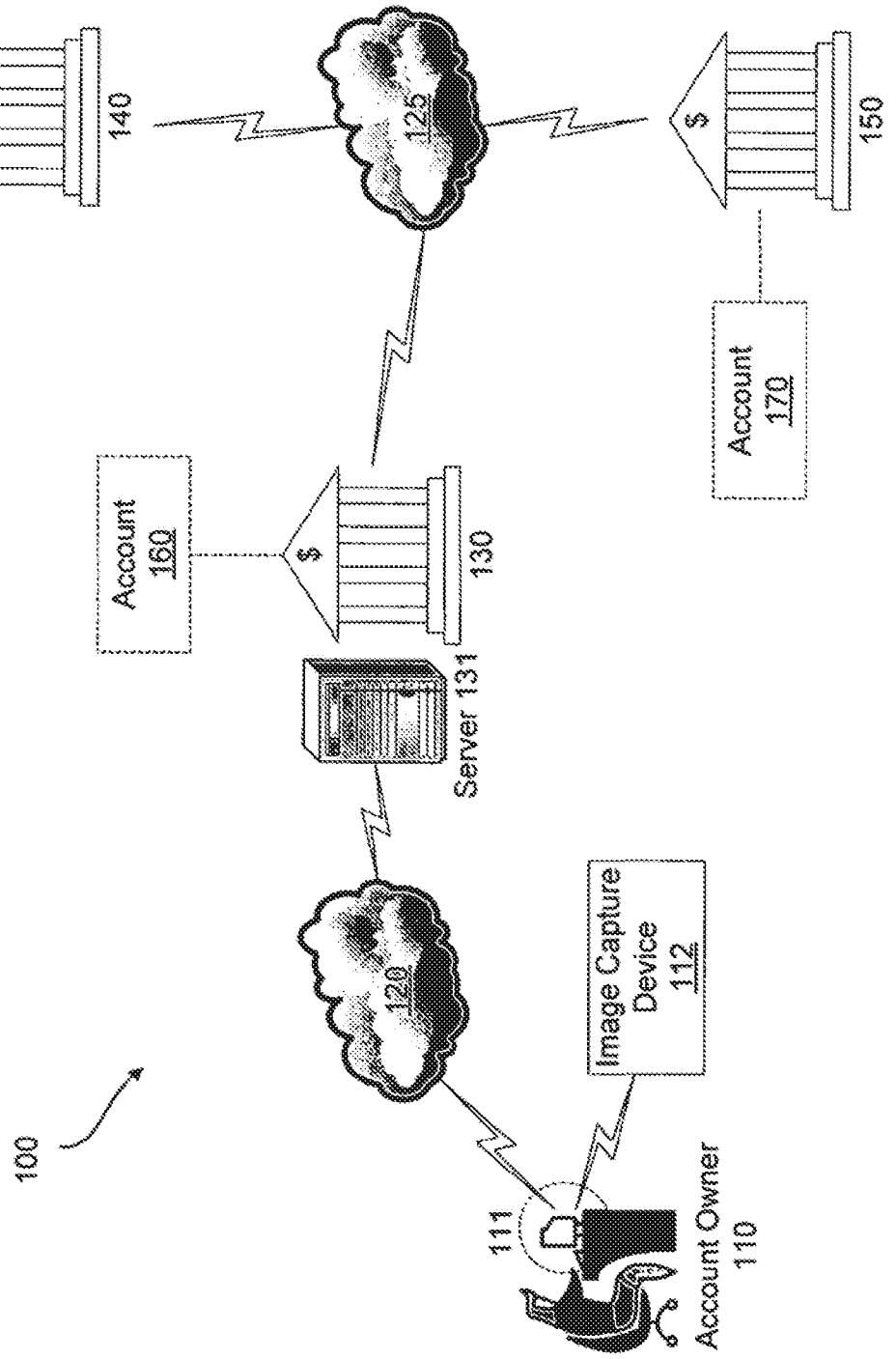
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FIGURE 1

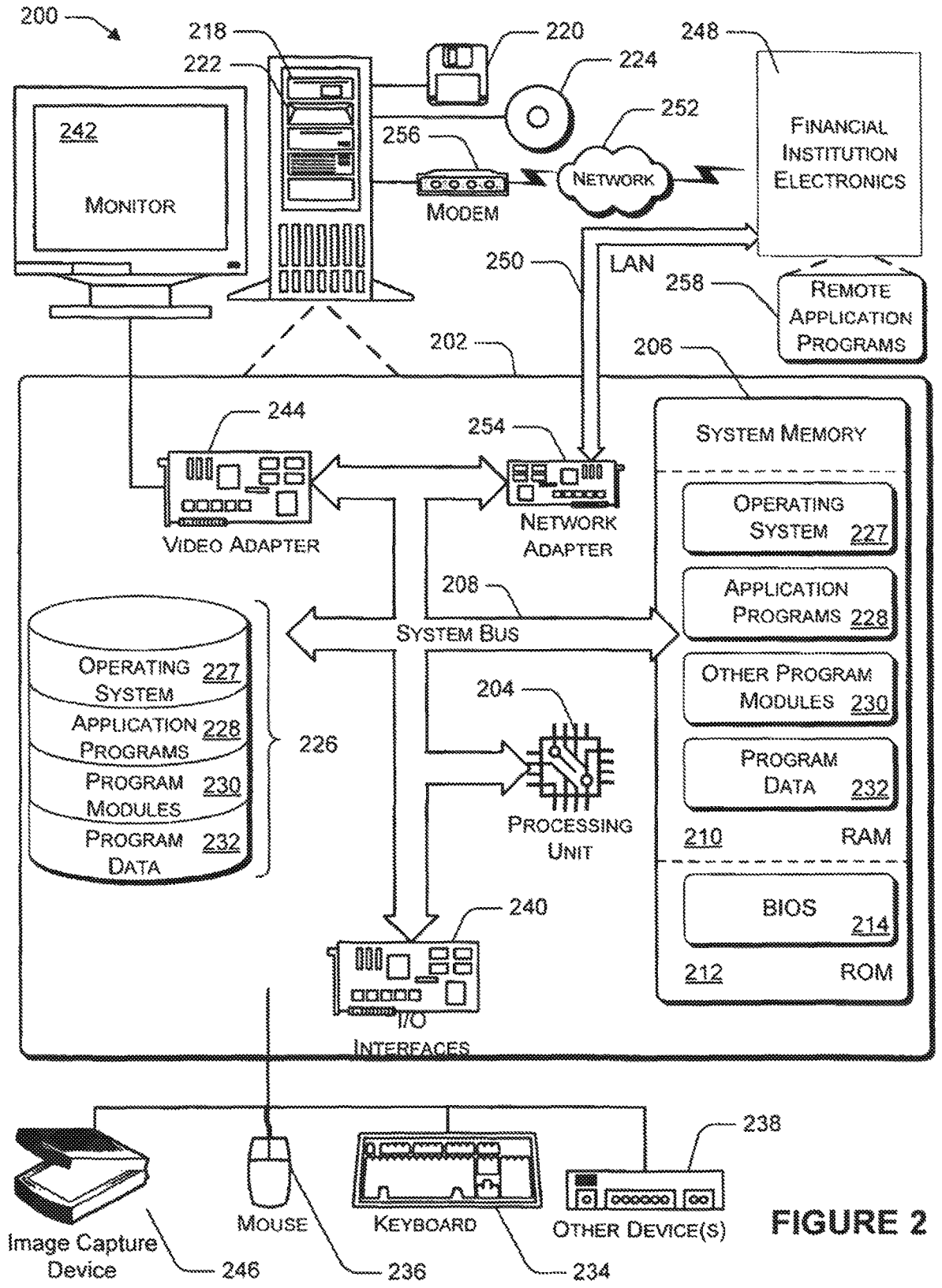
200
218
222
220
224
248
242
MONITOR
256
MODEM
252
NETWORK
FINANCIAL INSTITUTION ELECTRONICS
250
LAN
258
REMOTE APPLICATION PROGRAMS
202
206
244
VIDEO ADAPTER
254
NETWORK ADAPTER
SYSTEM MEMORY
OPERATING SYSTEM 227
APPLICATION PROGRAMS 228
OTHER PROGRAM MODULES 230
PROGRAM DATA 232
210 RAM
BIOS 214
212 ROM
208
SYSTEM BUS
OPERATING SYSTEM 227
APPLICATION PROGRAMS 228
PROGRAM MODULES 230
PROGRAM DATA 232
226
204
PROCESSING UNIT
240
I/O INTERFACES
238
Image Capture Device
246
MOUSE
236
KEYBOARD
234
OTHER DEVICE(S)

FIGURE 2

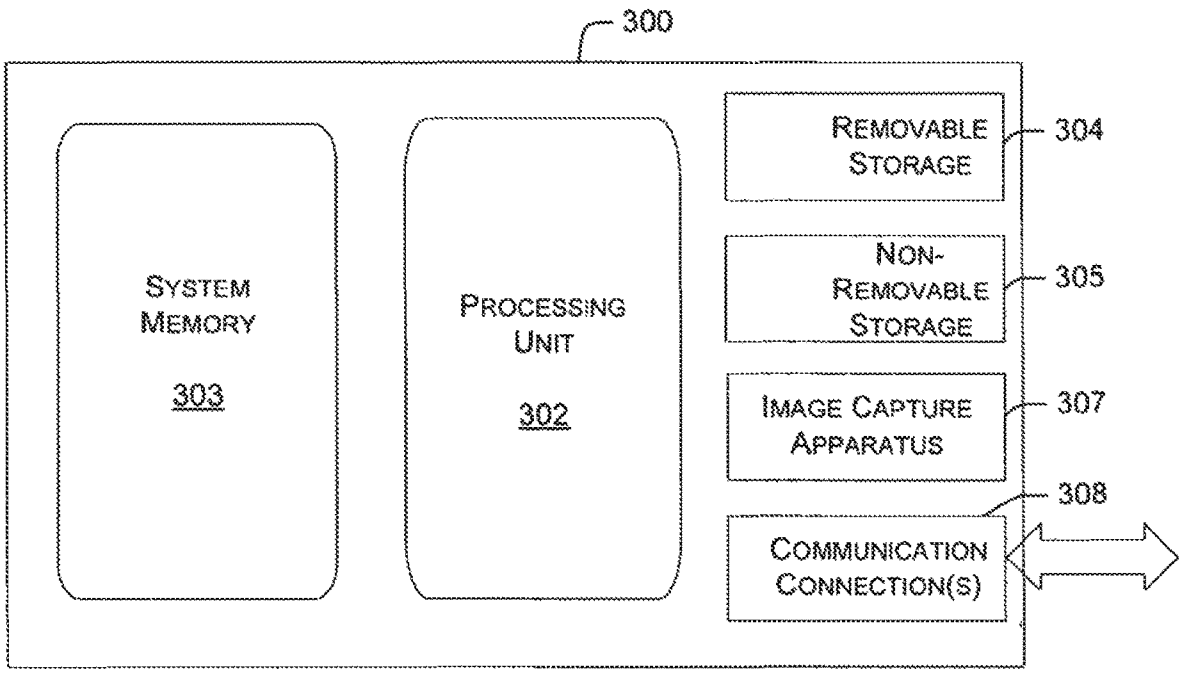
300
SYSTEM MEMORY
303
PROCESSING UNIT
302
REMOVABLE STORAGE
304
NON-REMOVABLE STORAGE
305
IMAGE CAPTURE APPARATUS
307
308
COMMUNICATION CONNECTION(S)

FIGURE 3

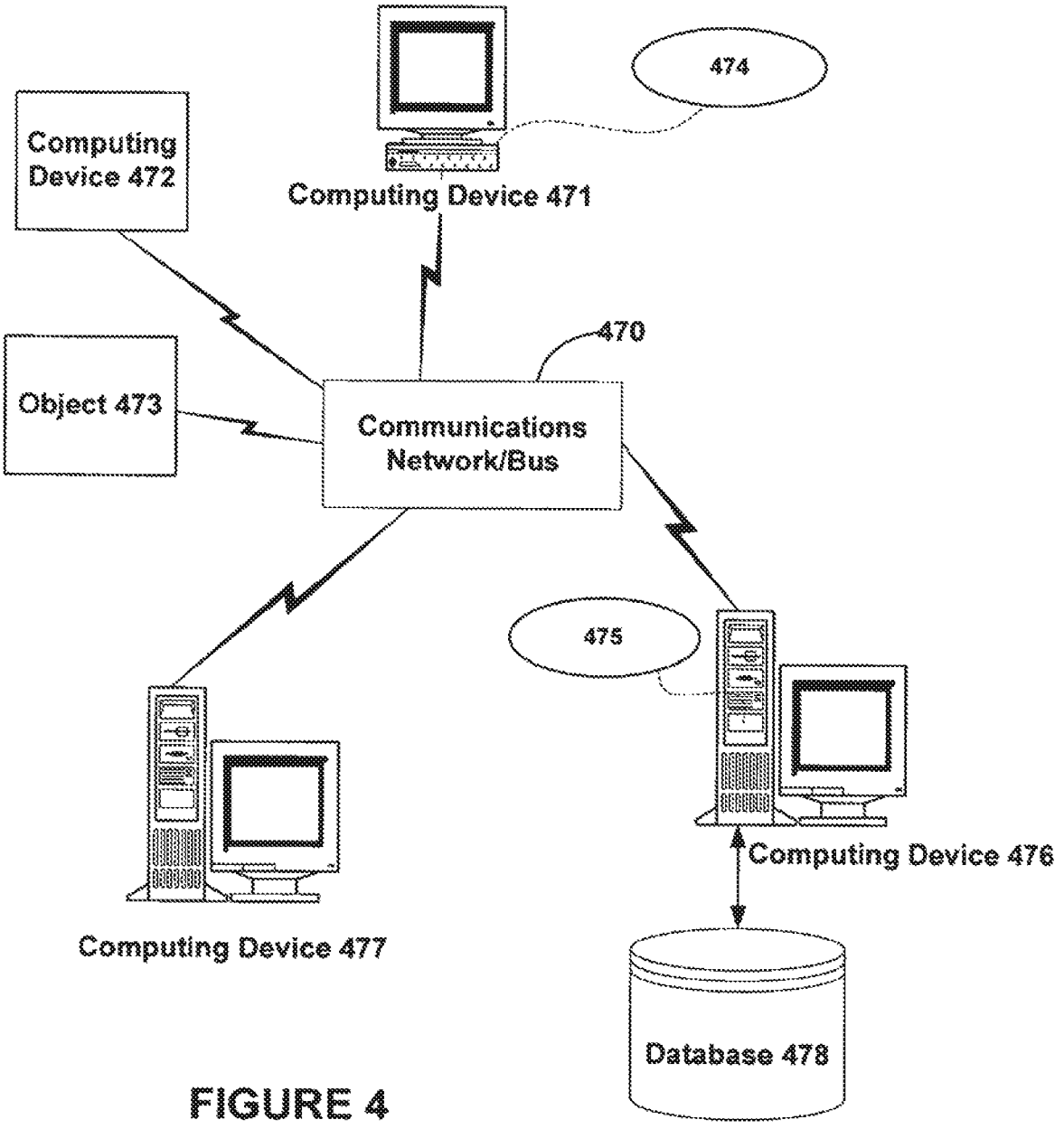
474
Computing Device 472
Computing Device 471
470
Object 473
Communications Network/Bus
475
Computing Device 476
Computing Device 477
Database 478

FIGURE 4

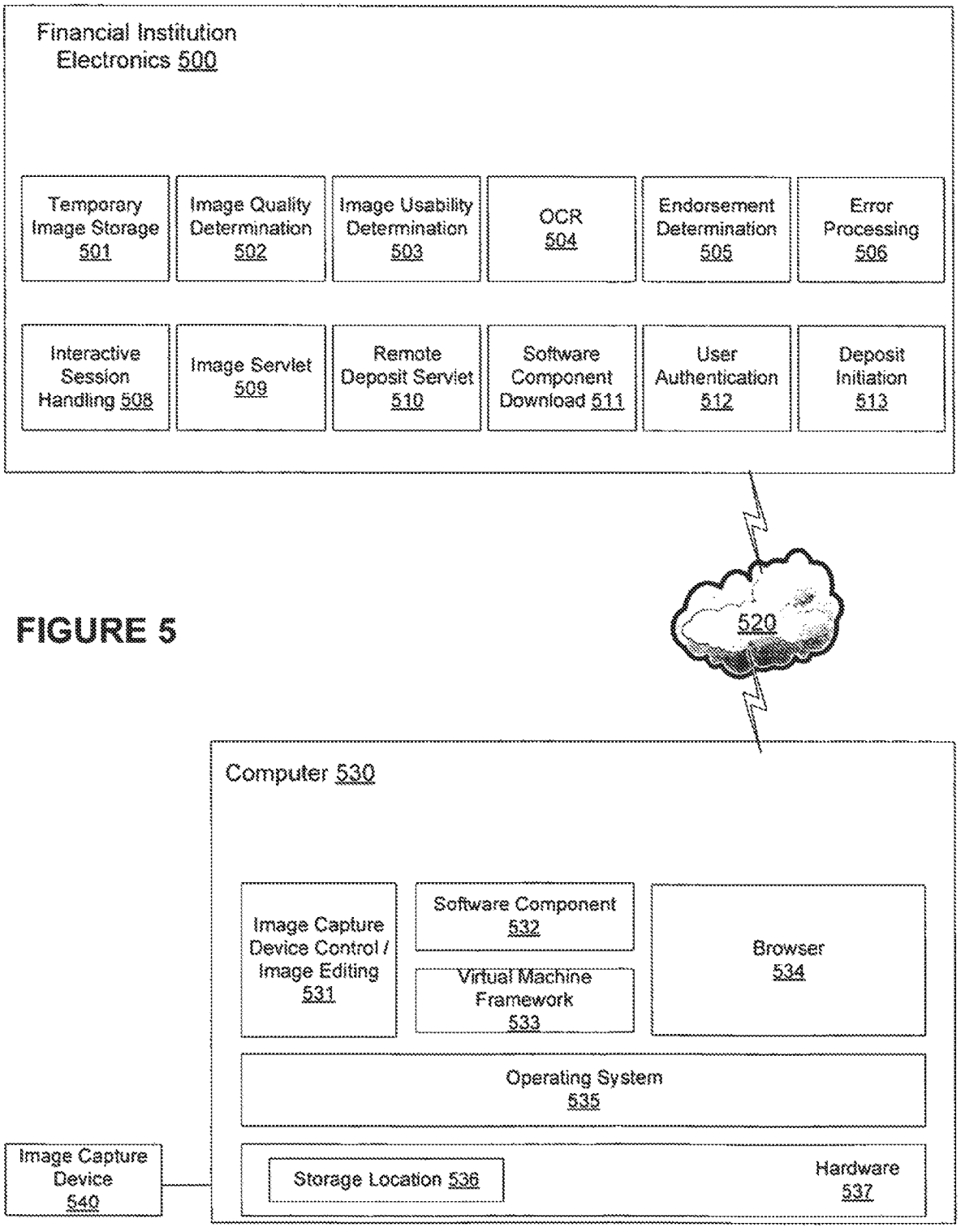
Financial Institution Electronics 500
Temporary Image Storage 501
Image Quality Determination 502
Image Usability Determination 503
OCR 504
Endorsement Determination 505
Error Processing 506
Interactive Session Handling 508
Image Servlet 509
Remote Deposit Servlet 510
Software Component Download 511
User Authentication 512
Deposit Initiation 513
520
Computer 530
Image Capture Device Control / Image Editing 531
Software Component 532
Virtual Machine Framework 533
Browser 534
Operating System 535
Storage Location 536
Hardware 537
Image Capture Device 540

FIGURE 5

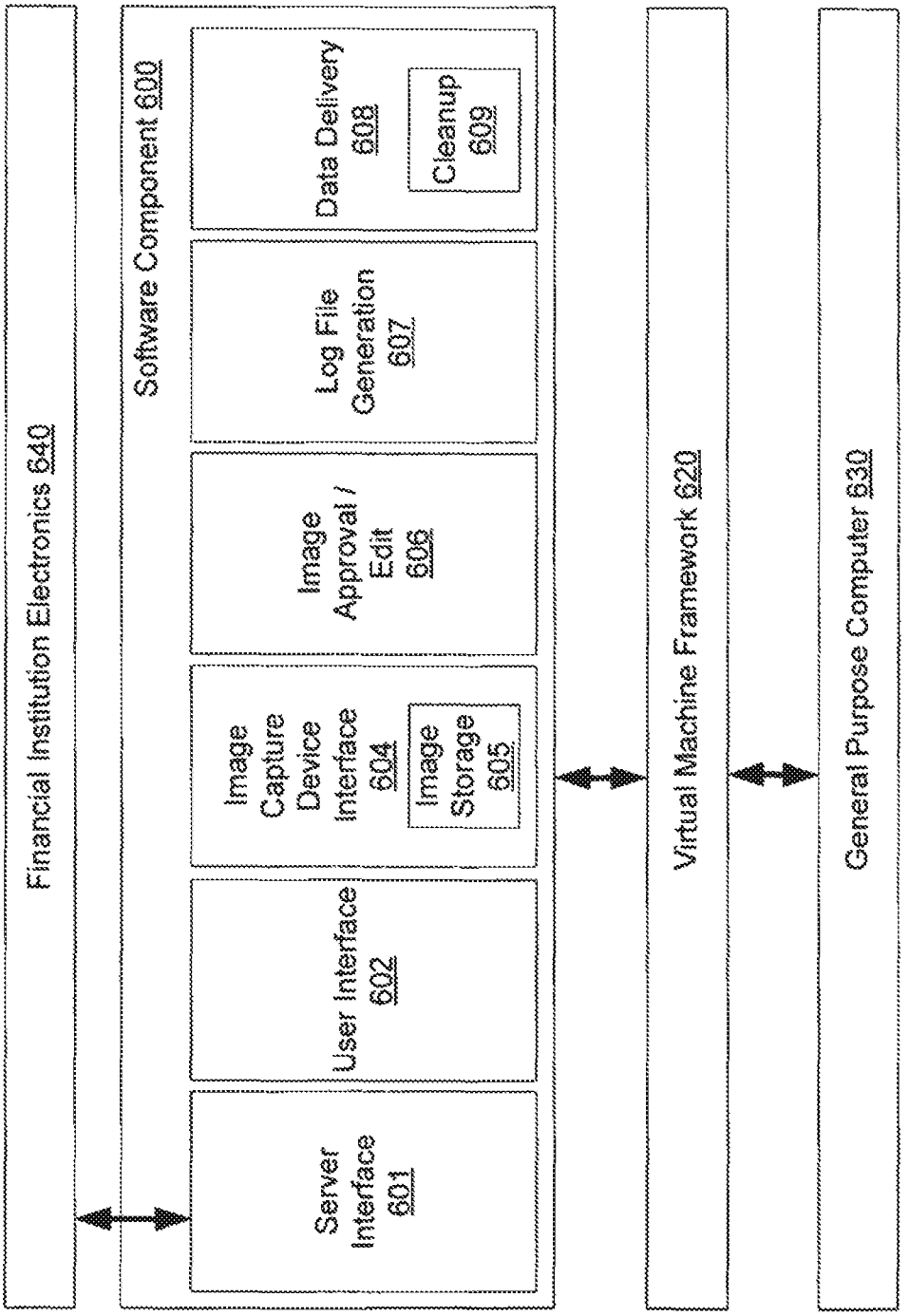
Financial Institution Electronics 640
Software Component 600
Server Interface 601
User Interface 602
Image Capture Device Interface 604
Image Storage 605
Image Approval / Edit 606
Log File Generation 607
Data Delivery 608
Cleanup 609
Virtual Machine Framework 620
General Purpose Computer 630

FIGURE 6

# DIGITAL CAMERA PROCESSING SYSTEM

## CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of U.S. patent application Ser. No. 16/165,622, filed on Oct. 19, 2018, pending, which is a continuation of U.S. patent application Ser. No. 16/025,679, filed on Jul. 2, 2018, pending, which is a continuation of both U.S. patent application Ser. No. 14/225,090, filed Mar. 25, 2014, pending, and U.S. patent application Ser. No. 15/663,284, filed on Jul. 28, 2017 (issued as U.S. Pat. No. 10,013,605 on Jul. 3, 2018). where U.S. patent application Ser. No. 15/663,284 is a continuation of U.S. patent application Ser. No. 14/225,090, filed on Mar. 25, 2014, pending, and where U.S. patent application Ser. No. 14/225,090 is a continuation of U.S. patent application Ser. No. 11/590,974, filed Oct. 31, 2006 (issued as U.S. Pat. No. 8,708,227 on Apr. 29, 2014), the entirety of all of which are hereby incorporated by reference herein.

Checks typically provide a safe and convenient method for an individual to purchase goods and/or services. To use a check, the individual usually must open a checking account, or other similar account, at a financial institution and deposit funds, which are then available for later withdrawal. To pay for goods and/or services with a check, the payor (i.e., the buyer) usually designates a payee (i.e., the seller) and an amount payable on the check. In addition, the payor often signs the check. Once the check has been signed, it is usually deemed negotiable, meaning the check may be validly transferred to the payee upon delivery. By signing and transferring the check to the payee, the payor authorizes funds to be withdrawn from the payor's account on behalf of the payee in return for the goods and/or services provided by the payee.

Checks have certain advantages over other forms of payment, such as cash. For example, while often considered the most liquid type of asset, cash also may be the least secure. Unlike a check, cash is usually freely transferable and does not have to be endorsed. Thus, the owner and possessor of cash is most often the same individual. Because cash is freely transferable, cash that is lost or stolen typically cannot be recovered. Therefore, the risks associated with cash transactions are often unacceptable, particularly with respect to transactions not conducted in person (e.g., by mail) and/or involving large sums of money. A check, on the other hand, provides a payor with more security because the check usually requires a payor to specify both the person and amount to be paid. Furthermore, as noted above, the check is usually not valid until it is properly signed by the payor. These safeguards help to reduce the risk that money will be lost and/or stolen and ensure that the proper payee receives the proper amount of money.

Cash may have other disadvantages as well. For example, because cash is freely transferable, there may be little or no verifiable transaction history. It is often desirable for a payor and/or payee to have physical proof that a particular transaction took place. This typically requires that the payor receive a receipt. However, receipts may contain errors and can be easily misplaced. In contrast, a bank processing a check will ordinarily create a transaction history, which may include the identity of the payee, the amount to be paid, the date of the payment, and the signature of the payor. This enables both a payor and payee to independently verify the accuracy of most transactions involving a payment by check.



While a check may provide a payor with a convenient and secure form of payment, receiving a check may put certain burdens on the payee, such as the time and effort required to deposit the check. For example, depositing a check typically involves going to a local bank branch and physically presenting the check to a bank teller. In addition to the time commitment that may be required, visiting a bank branch may be problematic for the payee if the bank's hours of operation coincide with the payee's normal hours of employment. Thus, the payee may be required to leave work early and/or change work schedules.

A check may pose other burdens for the payee. As noted above, a check may not be freely transferable, thereby limiting the payee's ability to use funds from the check. For example, it is usually difficult to for the payee to purchase goods and/or services using a check issued by the payor. While the check may be endorsed and accepted by a third party, such transactions are often disfavored because the third party may not know the payor and, thus, may not be willing to accept the risk that the payor has insufficient funds to cover the check. Therefore, the payee may not have access to the funds from the check until the payee deposits the check at the bank, the check has cleared and the funds have been credited to the payee's account. The payee may have to wait even longer if the payee chooses to deposit the check by mail. Therefore, there is a need for a convenient method of remotely depositing a check while enabling the payee to quickly access the funds from the check.

The described embodiments contemplate a system, method and computer-readable medium with computer-executable instructions for remotely redeeming a negotiable instrument. In an embodiment, a novel system may include financial institution electronics, such as a server equipped with appropriate hardware and software for facilitating deposit of a check. Such electronics may be configured for receiving from a customer computer an identification of an account for deposit of a check, and an amount of said check. They may be further configured for receiving an image of a front side of said check, and for analyzing said image to determine if it meets at least one criterion. The criterion could be, for example, image size, image legibility, image orientation, image format, presence of certain image features that indicate the image in fact represents a check, and so forth. Financial institution electronics may be also configured for determining if there is an error in a deposit transaction. Numerous errors are possible candidates for detection, and several exemplary errors are provided herein. If there are no errors that warrant aborting the transaction, then such electronics may be further configured to initiate a deposit of the check.

In another embodiment, a novel system may include, for example, a computer readable medium bearing instructions that can configure a customer's general purpose computer to facilitate a check deposit. Acting under direction of such instructions, the general purpose computer may instruct a customer, for example via a display coupled such computer, in utilizing an image capture device to generate an electronic image of a front side of a check, such that said electronic image of a front side of a check meets at least one first criterion such as image size, image legibility, image orientation, image quality, and location and/or orientation of the check within the image. Instructions may further be provided for receiving the image of a front side of a check from said image capture device, and optionally instructing the customer to process the image, e.g., by approving the image and/or modifying it to meet at least one second criterion. A second criterion might also be, for example, one or more of

image size, image legibility, image orientation, image quality, and location and/or orientation of the check within the image. Finally, the customer computer, acting under direction of the instructions, may deliver an approved electronic image to financial institution electronics.

Additional advantages and features of the invention are described below.

## BRIEF DESCRIPTION OF THE DRAWINGS

The systems and methods for remote deposit of checks in accordance with the present disclosure are further described with reference to the accompanying drawings in which:

FIG. **1** illustrates a broad view of a system in which the described embodiments may be employed.

FIG. **2** an exemplary general purpose computing device that is communicatively coupled to financial institution electronics as well as an image capture device.

FIG. **3** illustrates an exemplary schematic architecture of an image capture device as may be used in connection with various embodiments of the invention.

FIG. **4** illustrates an exemplary network architecture as may connect the customer's general purpose computer to financial institution electronics and may also serve to connect components of financial institution electronics as well as various financial institutions to one another.

FIG. **5** illustrates financial institution electronics coupled to a computer **530**, and the various aspects of electronics **500** and computer **530** that may operate to implement the novel systems, methods, and computer readable media set forth herein.

FIG. **6** illustrates a view of the invention with particular focus on the software component **600** which may perform certain operations in connection with embodiments of the invention.

## DETAILED DESCRIPTION

Certain specific details are set forth in the following description and figures to provide a thorough understanding of various embodiments of the invention. Certain well-known details often associated with computing and software technology are not set forth in the following disclosure, however, to avoid unnecessarily obscuring the various embodiments of the invention. Further, those of ordinary skill in the relevant art will understand that they can practice other embodiments of the invention without one or more of the details described below. Finally, while various methods are described with reference to steps and sequences in the following disclosure, the description as such is for providing a clear implementation of embodiments of the invention, and the steps and sequences of steps should not be taken as required to practice this invention.

FIG. **1** illustrates an example system in which the described embodiments may be employed. System **100** may include account owner **110**, e.g., a bank customer who may be located, for example, at the customer's private residence. The account owner **110** may be utilizing a customer-controlled, general purpose computer **111**. General purpose computer may be coupled to an image capture device **112**. Customer **110** may use the image capture device **112** to generate an image of a negotiable instrument such as a check, and may send the image, along with any other data as appropriate, via a publicly accessible network **120** to financial institution **130** electronics such as server **131**.

In one embodiment, the financial institution controlling electronics **131** is also the institution at which the customer has an account **160**. Financial institution **130** may perform a variety of steps to process the incoming check image and other data. For example, financial institution may ensure the check is valid, ensuring the check image is in proper form for electronic handling, ensure it is not a duplicate of a previously deposited check, and so forth. Financial institution **130** may also forward the image over a network **125** to one or more other entities **140**, **150**, which may be associated with an account **170** on which the check was drawn.

A general purpose computer **111** is generally a Personal Computer (PC) running one of the well-known WINDOWS® brand operating systems made by MICROSOFT® Corp., or a MACINTOSH® (Mac) brand computer, running any of the APPLE® operating systems. General purpose computers are ubiquitous today and the term should be well understood. A general purpose computer **111** may be in a desktop or laptop configuration, and generally has the ability to run any number of applications that are written for and compatible with the computer's operating system. The term "general purpose computer" specifically excludes specialized equipment as may be purchased by a business or other commercial enterprise, for example, for the specialized purpose of high-speed, high-volume check deposits. A particular advantage of embodiments of the invention is its ability to operate in conjunction with electronics that today's consumers actually own or can easily acquire, such as a general purpose computer, a scanner, and a digital camera.

An exemplary general purpose computer **111** as may be utilized in conjunction with embodiments of the invention is illustrated in FIG. **2**. Device electronics **200** are illustrated in FIG. **2**, and a schematic blowup **202** is provided to illustrate an exemplary internal architecture of the device. Computing architecture **202** includes one or more processors or processing units **204**, a system memory **206**, and a bus **208** that couples various system components including the system memory **206** to processors **204**. The bus **208** represents one or more of any of several types of bus structures, including a memory bus or memory controller, a peripheral bus, an accelerated graphics port, and a processor or local bus using any of a variety of bus architectures. The system memory **206** includes read only memory (ROM) **212** and random access memory (RAM) **210**. A basic input/output system (BIOS) **214**, containing the basic routines that help to transfer information between elements within computing device **200**, such as during start-up, is stored in ROM **212**.

Computing architecture **202** further includes a hard disk drive **226**, and may include a magnetic disk drive **2218** for reading from and writing to a removable magnetic disk **220**, and an optical disk drive **222** for reading from or writing to a removable optical disk **224** such as a CD ROM or other optical media. The hard disk drive **226**, magnetic disk drive **218**, and optical disk drive **224** are connected to the bus **208** by appropriate interfaces. The drives and their associated computer-readable media provide nonvolatile storage of computer-readable instructions, data structures, program modules and other data for computing device **200**. Although the exemplary environment described herein employs a hard disk, a removable magnetic disk **218** and a removable optical disk **224**, other types of computer-readable media such as magnetic cassettes, flash memory cards, digital video disks, random access memories (RAMs), read only memories (ROMs), and the like, may also be used in the exemplary operating environment.

A number of program modules may be stored on the hard disk **226**, magnetic disk **218**, optical disk **224**, ROM **212**, or RAM **210**, including an operating system **227**, one or more application programs **228**, other program modules **230**, and

program data **232**. A user may enter commands and information into computing device **200** through input devices such as a keyboard **234** and a pointing device **236**. An image capture device **246** may also be coupled to the general purpose computer **200** as an input device. Other input devices **238** may include a microphone, joystick, game pad, satellite dish, or the like. These and other input devices are connected to the processing unit **204** through interfaces **240** that are coupled to the bus **208**. A monitor **242** or other type of display device is also connected to the bus **208** via an interface **224**, such as a video adapter **224**.

Generally, the data processors of computing device **200** are programmed by means of instructions stored at different times in the various computer-readable storage media of the computer. Programs and operating systems may be distributed, for example, on floppy disks, CD-ROMs, or electronically, and are installed or loaded into the secondary memory of a computer. At execution, the programs are loaded at least partially into the computer's primary electronic memory **206**.

Computing device **200** may operate in a networked environment using logical connections to one or more remote computers, such as financial institution electronics **248**. The financial institution electronics **248** may be one or more server computers, routers, network PCs, and so forth, which typically include many or all of the elements described above relative to computing device **200**. The financial institution electronics **248** may run remote application programs **258** which may operate in concert with application programs **228** that execute on the computer **200**. For example, a "software component" as described herein may, in one embodiment, execute pursuant to commands from a remote application program **258**. The software component may of course also operate in a more autonomous manner, performing certain tasks and then communicating data as necessary back to the remote application programs **258**.

When used in a LAN networking environment, a computer **200** is connected to a local network **250** through a network interface or adapter **254**. When used in a WAN networking environment, computing device **200** typically includes a modem **256** or other means for establishing communications over the wide area network **252**, such as the Internet. The modem **256**, which may be internal or external, can be connected to the bus **208** for example via a serial port interface, or by sending a signal to a wireless router which then broadcasts and receives wireless signals to and from a wireless card that is connected to the computer **200**.

In a networked environment, program modules depicted relative to the computing device **200**, or portions thereof, may be stored in the remote memory storage device. It will be appreciated that the network connections shown are exemplary and other means of establishing a communications link between the computers may be used.

A general purpose computer such as **200** may also be "customer-controlled." A common example of a customer-controlled computer would be a typical computer located in a private residence. The owner of such a computer typically has the power to install programs and configure the computer as they wish, subject to certain security restrictions that may be imposed by the hardware or software manufacturers. A customer-controlled computer need not be located in a private residence, however. For example, computers in college dormitories, in workplace offices, and so forth may also be considered to be "customer-controlled."

An example of a computer that would not be considered customer-controlled would be an Automatic Teller Machine (ATM) that is typically controlled by a bank or other business. Although a customer may access and utilize an ATM machine, the ATM machine is not customer-controlled because the allowed uses of the ATM machine are highly restricted. Relevant factors in determining whether a machine is customer controlled are thus the scope of operations that a customer may perform using the machine, and extent to which the customer can reconfigure the machine in some way by adding software and/or hardware components.

One of the applications **228** that may run on a general purpose computer **200** in connection with the invention is a browser. Common browsers in use today are, for example, the popular INTERNET EXPLORER® line of browsers made by MICROSOFT® Corp., the FIREFOX® browsers distributed via the MOZILLA® open source project, and the NETSCAPE NAVIGATOR® browsers also distributed via the MOZILLA® open source project. Browsers generally allow users to point to a Uniform Resource Locator (URL), and thereby retrieve information such as a web page. For example, a browser application on computer **200** could retrieve a web page that is kept at server associated with financial institution electronics **248**, and display the web page on display **242** to the account owner **110** (FIG. **1**), as is generally known and appreciated in the industry and by the general public.

Another application **228**, or set of applications, that may run on a general purpose computer **200** in connection with the invention comprises "virtual machine" technologies such as the JAVA® virtual machine software distributed by SUN MICROSYSTEMS® Corp, and .NET® Framework distributed by MICROSOFT® Corp. In general, such applications facilitate execution of further application programs **228** in a variety of computing environments. For example, a JAVA® applet is a computer program (which may be alternatively referred to herein as a "software component") that can execute on any computer running the JAVA® virtual machine software. The applet may be provided to virtual machine software in a "source code" format, and may be compiled by a "just in time" compiler, so as to put the applet in a form that can be executed by the hardware associated with the particular computing device. These technologies are known in the art and may be utilized in connection with certain embodiments of the invention as described herein.

Referring back to FIG. **1**, an image capture device **112** may be communicatively coupled to the computer **111**. Image capture device **112** may be, for example, a scanner or digital camera. Computer **111** may comprise software that allows the user to control certain operations of the image capture device **112** from the computer **111**. For example, modern scanner users may be familiar with the TWAIN® software is often used to control image capture from a computer **111**. Similarly, digital cameras often ship along with software that allows users to move images from the camera to a computer **111**, and may also provide additional functions, such as photo editing functions crop and rotate.

Referring now to FIG. **3**, a schematic illustration of an exemplary image capture device architecture **300** is illustrated. As with the general purpose computer **200** of FIG. **2**, an image capture device may comprise a processing unit **302** and memory **303**. Depending on the exact configuration and type of image capture device, memory **303** may be volatile (such as RAM), non-volatile (such as ROM, flash memory, etc.) or some combination of the two. Additionally, image capture device **300** may have mass storage (removable **304** and/or non-removable **305**) such as magnetic or optical disks or tape. Image capture device **300** may have image capture apparatus **307** such as a scanner bed, camera lens, and so forth. Finally, image capture device **300** may include com-

munication connections **308** to other devices, computers, networks, servers, etc. using either wired or wireless media. In particular, communication connections **308** may serve to communicatively couple device to a general purpose computer such as provided in FIG. **2**.

Referring back to FIG. **1**, financial institutions **130**, **140** and **150** may be any type of entity capable of processing a transaction involving a negotiable instrument. For example, financial institutions **130**, **140** and **150** may be a retail bank, investment bank, investment company, regional branch of the Federal Reserve, clearinghouse bank and/or correspondent bank. A negotiable instrument is usually a type of contract that obligates one party to pay a specified sum of money to another party. By way of example, and not limitation, negotiable instruments may include a check, draft, bill of exchange, promissory note, and the like.

Financial institution **130** is illustrated as associated with a server **131**. Financial institution **130** may maintain and operate server **131** for the purposes of communicating with customers such as **110**. Alternatively, such server may be maintained and operated by one or more third party vendors who act under the instructions of the financial institution **130**, but possess skills and resources that may be more effective in competent operation of electronics. Such arrangements are well known in the industry and in this case the server **131** is nonetheless considered to be "associated" with the financial institution **130**.

Account owner **110** may be an individual who owns account **160**, which may be held at financial institution **130**. As such, account owner **110** may be described as a customer of financial institution **130** and/or a "payee" because it is contemplated that customer **110** may deposit a check made out to him- or herself. Embodiments of the invention are also possible, however, in which the customer deposits a check made to another payee, in which case the customer and payee are not one and the same. Account **160** may be any type of account for depositing funds, such as a savings account, checking account, brokerage account, and the like. Account owner **110** may communicate with financial institution **130** by way of communication network **120**, which may include an intranet, the Internet, a local area network (LAN), a wide area network (WAN), a public switched telephone network (PSTN), a cellular network, a voice over internet protocol (VoIP) network, and the like. Account owner **110** may communicate with financial institution **130** by phone, email, instant messaging, facsimile, and the like.

In one contemplated embodiment, network **120** is a publicly accessible network such as the Internet, which can presently be accessed from many private residences and many public places such as college campuses, airports, coffee shops, and restaurants throughout the United States as well as many other countries of the world. A variety of technologies are available to establish secure connections over such a public network, so that data transmitted between computer **111** and a server **131** associated with the institution **130** remains either inaccessible or indecipherable by third parties that may intercept such data. The invention may make use of any such security technologies.

Financial institutions **130**, **140** and **150** may communicate with each other via a network **125**. Network **125** may be a publicly accessed network such as **120**. Alternatively, network **125** may have certain characteristics that differ from network **120**, due to the different requirements of bank-to-bank communications. For example, one might envision certain security features and access restrictions being more important in bank-to-bank communications.

FIG. **4** illustrates an exemplary computer network as may be implemented in connection with **120** and **125**. One of ordinary skill in the art can appreciate that networks can connect any computer or other client or server device, or in a distributed computing environment. In this regard, any computer system or environment having any number of processing, memory, or storage units, and any number of applications and processes occurring simultaneously is considered suitable for use in connection with the systems and methods provided.

Distributed computing provides sharing of computer resources and services by exchange between computing devices and systems. These resources and services include the exchange of information, cache storage and disk storage for files. Distributed computing takes advantage of network connectivity, allowing clients to leverage their collective power to benefit the entire enterprise. In this regard, a variety of devices may have applications, objects or resources that may implicate the processes described herein.

FIG. **4** provides a schematic diagram of an exemplary networked or distributed computing environment. The environment comprises computing devices **471**, **472**, **476**, and **477** as well as objects **473**, **474**, and **475**, and database **478**. Each of these entities **471**, **472**, **473**, **474**, **475**, **476**, **477** and **478** may comprise or make use of programs, methods, data stores, programmable logic, etc. The entities **471**, **472**, **473**, **474**, **475**, **476**, **477** and **478** may span portions of the same or different devices such as PDAs, audio/video devices, MP3 players, personal computers, etc. Each entity **471**, **472**, **473**, **474**, **475**, **476**, **477** and **478** can communicate with another entity **471**, **472**, **473**, **474**, **475**, **476**, **477** and **478** by way of the communications network **470**. In this regard, any entity may be responsible for the maintenance and updating of a database **478** or other storage element.

This network **470** may itself comprise other computing entities that provide services to the system of FIG. **4**, and may itself represent multiple interconnected networks. In accordance with an aspect of the invention, each entity **471**, **472**, **473**, **474**, **475**, **476**, **477** and **478** may contain discrete functional program modules that might make use of an API, or other object, software, firmware and/or hardware, to request services of one or more of the other entities **471**, **472**, **473**, **474**, **475**, **476**, **477** and **478**.

It can also be appreciated that an object, such as **475**, may be hosted on another computing device **476**. Thus, although the physical environment depicted may show the connected devices as computers, such illustration is merely exemplary and the physical environment may alternatively be depicted or described comprising various digital devices such as PDAs, televisions, MP3 players, etc., software objects such as interfaces, COM objects and the like.

There are a variety of systems, components, and network configurations that support distributed computing environments. For example, computing systems may be connected together by wired or wireless systems, by local networks or widely distributed networks. Currently, many networks are coupled to the Internet, which provides an infrastructure for widely distributed computing and encompasses many different networks. Any such infrastructures, whether coupled to the Internet or not, may be used in conjunction with the systems and methods provided.

A network infrastructure may enable a host of network topologies such as client/server, peer-to-peer, or hybrid architectures. The "client" is a member of a class or group that uses the services of another class or group to which it is not related. In computing, a client is a process, i.e., roughly a set of instructions or tasks, that requests a service

provided by another program. The client process utilizes the requested service without having to "know" any working details about the other program or the service itself. In a client/server architecture, particularly a networked system, a client is usually a computer that accesses shared network resources provided by another computer, e.g., a server. In the example of FIG. **4**, any entity **471**, **472**, **473**, **474**, **475**, **476**, **477** and **478** can be considered a client, a server, or both, depending on the circumstances.

A server is typically, though not necessarily, a remote computer system accessible over a remote or local network, such as the Internet. The client process may be active in a first computer system, and the server process may be active in a second computer system, communicating with one another over a communications medium, thus providing distributed functionality and allowing multiple clients to take advantage of the information-gathering capabilities of the server. Any software objects may be distributed across multiple computing devices or objects.

Client(s) and server(s) communicate with one another utilizing the functionality provided by protocol layer(s). For example, HyperText Transfer Protocol (HTTP) is a common protocol that is used in conjunction with the World Wide Web (WWW), or "the Web." Typically, a computer network address such as an Internet Protocol (IP) address or other reference such as a Universal Resource Locator (URL) can be used to identify the server or client computers to each other. The network address can be referred to as a URL address. Communication can be provided over a communications medium, e.g., client(s) and server(s) may be coupled to one another via TCP/IP connection(s) for high-capacity communication.

Returning again to FIG. **1**, in an embodiment, account owner **110** may wish to deposit a check that is drawn from account **170** at financial institution **150**. Account owner **110** may deposit the check into account **160** by converting the check into electronic data and sending the data to financial institution **130**. Aspects of the invention may thus comprise systems and methods carried out by the account owner **110** and his computer **111**. Aspects of the invention may also comprise systems and methods carried out by the financial institution **130** and their server **131** or other electronics that facilitate and enable such deposit by the account owner **110**.

For example, account owner **110** may convert the check into a digital image by scanning the front and/or back of the check using image capture device **112**. Account owner **110** may then send the image to financial institution **130** using the systems and methods described herein. Please refer to FIG. **5** and corresponding description for a detailed exemplary embodiment of systems and methods for facilitating and processing a check deposit transaction. Upon receipt of the image, financial institution **130** may credit the funds to account **160**. Financial institution **130** may clear the check by presenting the digital image to an intermediary bank, such as a regional branch of the Federal Reserve, a correspondent bank and/or a clearinghouse bank.

For example, the check may be cleared by presenting the digital image to financial institution **140**, which may be a regional branch of the Federal Reserve, along with a request for payment. Financial institution **130** and **150** may have accounts at the regional branch of the Federal Reserve. As will be discussed in greater detail below, financial institution **130** may create a substitute check using the image provided by account owner **110** and present the substitute check to financial institution **140** for further processing. Upon receiving the substitute check, financial institution **140** may identify financial institution **150** as the paying bank (e.g., the bank from which the check is drawn). This may be accomplished using a nine-digit routing number located on the bottom left hand corner of the check. A unique routing number is typically assigned to every financial institution in the United States. Financial institution **140** may present the substitute check to financial institution **150** and request that the check be paid. If financial institution **150** verifies the check (i.e., agrees to honor the check), financial institution **140** may then settle the check by debiting funds from financial institution **150** and crediting funds to financial institution **130**. Financial institution **150** may then debit funds from account **170**.

It will be appreciated that the preceding examples are for purposes of illustration and explanation only, and that an embodiment is not limited to such examples. For example, financial institution **150** may be a correspondent bank (i.e., engaged in a partnership with financial institution **130**). Thus, financial institution **130** may bypass the regional branch of the Federal Reserve and clear the check directly with financial institution **150**. In addition, account **160** and account **170** may both be held at financial institution **130**, in which case the check may be cleared internally.

FIG. **5** illustrates a system for facilitating deposit of a check, in which financial institution electronics **500** communicate with a computer **530** via network **520**. There are a variety of unique aspects which may be described with reference to FIG. **5**. We begin with a description of operations that may be carried out by the financial institution electronics **500**, which will be referred to for the sake of simplicity as "server **500**" with the understanding that additional electronics may be involved.

Server **500** may comprise a subsystem **511** for providing a software component **532** to a computer **530**. This subcomponent may require the customer to download a virtual machine framework **533** so that the component **532** is operable on the operating system **535** and hardware **537** of the computer **530**. In general, the software component allows the financial institution to control certain aspects of check image creation and delivery by the computer **530**. Thus, while the computer **530** may be customer-controlled, the customer downloads component **532** to facilitate a deposit, thereby allowing a financial institution to effectively control certain aspects of the image generation and delivery process.

Server **500** may also comprise a subsystem for user authentication **512**, such as by requiring a username and password. Other authentication methods such as requiring a digital certificate, data representing a customer fingerprint, and so forth are also possible. User authentication can open an interactive session supported by a component such as **508**, in which the user can exchange information with the server **500** and receive instructions from the server **500**. In addition, server **500** may, in some embodiments, control operation of the software component **532**.

Server **500** may comprise a subsystem for receiving from a customer-controlled general purpose computer such as **530**, an identification of an account for deposit of a check, and an amount of said check. "Remote deposit servlet" **510** may for example provide such functions. Remote deposit servlet **510** may provide a user interface (or user interface data) to a browser **534**, and such user interface may prompt a customer to enter information such as an account number and an amount of a check for deposit. In an embodiment where multiple checks are being deposited at once, the customer may itemize the checks by writing an amount of each. It will be appreciated that servlet **510** need not directly

take responsibility for a website, and may instead merely communicate with one or more other subsystems that are responsible for doing so.

Server **500** may further comprise a subsystem for receiving from computer **530** an image of a front side of said check. "Image servlet" **509** is such a subsystem in the illustrated embodiment. In embodiments where software component **532** is responsible for delivering images to image servlet **509**, servlet **509** may be configured to communicate with component **532** as appropriate. In one embodiment, both an image of a front side of a check and an image of a back side of a check are received. These may be two separate images, or may be a single image in which the separately generated images are "stitched together" for simultaneous viewing as a single image.

Server **500** may further comprise a subsystem for analyzing said image of a front side of said check to determine if it meets at least one criterion. Subsystems **502** and **503** may for example perform such determining. In order to automate remote check deposits, it is desirable to configure server **500** to recognize that the image it receives is in fact a check, that the check is valid and not a duplicate, and that the received image can be used to further process the transaction. Image quality determination **502** may thus be provided to ensure that the received image can be used to further process the transaction.

Image usability determination subsystem **503** may further require an image to meet additional criteria. For example, it may be required that the image is in a particular format, e.g. a Joint Photographic Experts Group (JPEG) format. While systems may be designed to handle checks in any format, it may be cost effective to require customers to send in only images of specified formats so as to lower development costs of the system. It may also be required that the image is of a predetermined size, or that the image has features indicating it is a negotiable instrument of a desired type. For example, almost all checks have certain features, such as a MICR line, a signature line, an endorsement area on the back, an amount box, a date, and so forth. Often such features are in a consistent location on the check. A subsystem such as **503** may ensure that such features are present prior to allowing the transaction to continue.

Server **500** may further comprise a subsystem for performing Optical Character Recognition (OCR) on said image of said front side of said check. OCR can be useful in determining MICR line information such as routing number, account number, and check number. It can also be used to determine a check amount by performing OCR on the amount location of the check. Other information such as check date, payor name, payor financial institution, and so forth may be gleaned. Such information may be validated, for example, by comparing it to information such as a list of valid routing numbers, comparing an OCR-determined amount to a customer-entered amount, and so forth, or simply stored in a log file.

Server **500** may further comprise a subsystem for determining if there is an error in said deposit of said check. Error processing **506** may be responsible for this, and may comprise a variety of useful aspects. In one embodiment, error processing **506** may comprise a subsystem for validating a routing number associated with said check. In another embodiment, error processing **506** may comprise a subsystem for determining if said check was previously deposited. For example, if a list of deposited checks is maintained for the depositing customer, then the check number can be compared against such a list. Comparing to a list of all deposits for an entire financial institution, or even multiple financial institutions, is also possible. However, if duplicate checking is to be done in real time, i.e. while the customer waits for confirmation, then it is desirable to streamline the process for example by only determining duplicates from a predetermined set of most likely relevant data.

Error processing **506** may further comprise a subsystem for comparing an amount of a check as provided by a customer to an amount determined by performing OCR on said image of said front side of said check. If the numbers do not match, the server can indicate an error and as a result, not proceed with the deposit transaction. Similarly, such an error may result from any error checking operation performed herein. Alternatively, certain errors can be designated as not meriting aborting a deposit, and may simply result in flagging the transaction for later scrutiny. Such a "transaction flagging" approach is particularly applicable to situations in which a duplicate check deposit is identified. Because duplicate determinations are prone to false positives, simply flagging, rather than aborting, a transaction may be preferable when a duplicate is possible.

OCR may also be applied to an image of a back side of the check. For example, in one embodiment, an OCR analysis of a MICR line location on an alleged image of a back of a check can be made. Backs of checks should not have MICR lines. Therefore, if such OCR process identifies MICR information, it can be determined that the image of the back of a check is improper. Thus, one criterion in analyzing an image of a back of a check may be the absence of a MICR line.

Server **500** may further comprise an endorsement determination subsystem **505**. Such a subsystem **505** may determine if a signature appears on said back side of said check. While endorsement of a check is not legally required for depositing a check into the payee's bank account, there are a variety of reasons banks typically require endorsement by the payee. Endorsement determination **505** may comprise simply checking for some indication of handwriting in the endorsement area of the image of the back side of a check. Other embodiments may go further by attempting to recognize an authorized signature of the payee and/or customer.

Server **500** may further comprise temporary image storage **501** for storing images while performing operations such as OCR and error processing. Images stored in temporary storage may be in the original format, i.e. as received from computer **530**, or in some other format, such as the bi-tonal TIFF format required by Check **21** legislation, or both. In fact, it can be useful to include in some embodiments a mechanism for converting images from such first format to a second format such as bi-tonal TIFF, and to place such images in a log file.

Server **500** may further comprise a subsystem for initiating a deposit of a check into the specified account **513**. Deposit initiation may comprise a wide variety of possible actions, depending on how such operations are initiated in particular bank systems. For example, a deposit might be initiated by "soft posting" or provisionally posting a credit to the customer's account. It might be initiated by forwarding an image to the payor's bank or Federal Reserve. It might be initiated by placing data in a batch file for processing all the deposits for the day. Deposit initiation is any action that sets in motion a chain of automated events resulting in a crediting of the customer's account.

Referring now to computer **530**, a number of novel aspects also pertain to computer **530** as well as the interaction between the computer **530** and the server **500**. As described above, a software component **532** may be executed by computer **530** in connection with carrying out

the invention. One embodiment of the software component is illustrated in FIG. **6**. As illustrated in FIGS. **5** and **6**, an exemplary component **532** may execute in conjunction with a virtual machine framework **533** as described above. This gives the advantage of developing a single component that works predictably on most customer computers, which may be configured somewhat differently, for example having different hardware **537** and operating systems **535**.

A customer may connect to server **500** using a browser application **543** that executes on the computer **530**. The customer may view instructions in the browser, for example instructing the customer to log in, instructing the customer to place a check on or in front of an image capture device, instructing the customer to edit an image, and so forth. The browser may run in conjunction with the software component **532**, or the software component may run in a separate process and have its own user interface.

Image capture device control software and/or image edit software **531** may also execute on the computer **530**. This software **531** interfaces with the image capture device **540**, and may serve functions such as initiating image capture, managing image retrieval, facilitating image editing, and so forth. In one embodiment, software **531** may provide an interface so that it can be controlled to some extent by software component **532**. If software component is in turn controlled by image servlet **509**, the management of the image capture and retrieval process can be performed from the server **500**. Alternatively, at any step along the way, the customer can be instructed to perform certain functions using software **531** or component **432**, if such functions are better performed, or more conveniently performed by a human.

Storage location **536** provides a location that can be temporarily used by the component **532** to store images and/or a log file that may be generated to persist useful data regarding a deposit transaction.

Operations that are performed by the system comprising computer **530**, browser **534**, component **532**, image capture software **531**, image capture device **540**, and customer (not shown) can generally comprise providing customer credentials, identifying an account, identifying an amount of a deposit, capturing an image of a front side of a check according to the criteria required by the bank via component **532**, cropping and rotating the image of a front side of a check according to the criteria required by the bank via component **532**, endorsing and capturing an image of a back side of a check according to the criteria required by the bank via component **532**, and delivering such images to server **500**.

FIG. **6** illustrates a system for facilitating deposit of a check from a customer-controlled general purpose computer, with special focus on aspects of the software component **600**. As illustrated, an exemplary software component **600** may comprise a variety of functional subsystems **601**-**609**. The component may in one-embodiment be server-activated in that it executes various aspects of its functionality after receiving instructions to do so from a server **640**. As such, component **600** may have a server interface **601** for receiving commands from the server **640**.

As mentioned above, the component **600** may also be designed to interoperate with a virtual machine framework **620**, for the purpose of realizing certain benefits as understood in the art to accompany such technologies, such as facilitating widespread distribution and better guarantees of acceptable operation. The framework **620** in turn operates on the platform of the customer's general purpose computer **630**.

For example, the component **600** may provide a subsystem **602** for instructing a customer, for example via a user interface visible on a display coupled to a customer-controlled general purpose computer **630**, in utilizing an image capture device to generate an electronic image of a front side of a check, such that said electronic image of a front side of a check meets at least one first criterion. In one embodiment, the customer may be instructed for example to place the check face-down in a top left corner of a scanner bed. The customer may further be instructed to place the check in a certain orientation. An image thus produced will meet criteria such as being upright and at a "right angle" with respect to a rectangular image format.

The component **600** may also comprise a subsystem **604** such as image capture device interface for receiving an image of a front side of a check from the image capture device. The image may be immediately uploaded to the server **640**, or may be temporarily persisted using image storage function **605**. A reason for such temporary persisting is to allow for certain customer modifications, and to allow for generation of further images such as an image of a back side of the check. Although not necessary to the invention, it can be expedient to deliver all images to the server **640** at once.

Once an image is generated, subsystem **602** may further instruct the customer to process the electronic image of a front side of a check. Processing the image may comprise simply approving the image if said image of a front side of a check meets said at least one first criterion. This aspect may also be provided by another subsystem such as **606**. For example, the image may be presented to the customer and the customer may be asked if the image is right side up and legible. If so, the customer may approve the image, for example by selecting an appropriate approval button in the user interface.

Components **602**, **604**, **605**, and **606** may operate similarly with regard to capturing an image of a back side of a check. The customer may be instructed by **602** to capture an electronic image of a back side of a check meets at least one third criterion, which may in one embodiment be a same criterion as the first criterion, e.g. image size, image legibility, image orientation, and so forth. The image may be received by the component via **604**. The customer may also be asked to approve by **602**.

Further to being instructed by **602** and/or **606** to process an image, a customer may be instructed to modify said electronic image of a front side of a check and/or a back side of the check, such that said electronic image of a front side of a check meets at least one second criterion. For example, an image as scanned may be presented to the customer, and the customer may be asked to select a bottom right corner of the check in the image. Assuming the top left corner of the check is also in the top left corner of the image, the customer selection of the bottom right corner of the check can be used to crop out any and all of the image that goes beyond the boundaries of the check.

Component **600** may also comprise a subsystem for generating a log file **607** comprising data associated with said deposit. Exemplary data that may be collected in the log file is an identification of the operating system used by the customer's general purpose computer, an identification of a browser used by the customer's general purpose computer, an identification of an image capture device make and model, an identification of a version of the JAVA virtual machine software, or, if NET technologies are used, the version of the .NET Framework, and an identification of transaction data, for example a transaction ID, account

number, customer name, amount of deposit, check routing number, check number, check account number, and so forth.

Component **600** may also comprise a subsystem for data delivery **608** and cleanup **609**. The delivery subsystem **608** may initiate a delivery of images and other data, such as the log file, to the server. It may utilize functionality provided in the server interface **601** if desirable. The cleanup subsystem **609** may delete certain data from the customer's computer **630**. For example, any image files that may have been created for temporary purposes may be deleted. Thus cleanup subsystem **609** may remove an electronic image of a front side of a check from a memory associated with said customer-controlled general purpose computer **630**.

It should be appreciated that the various illustrations and examples provided herein also disclose corresponding methods and computer readable media bearing instructions for carrying out such methods. Furthermore, in addition to the specific implementations explicitly set forth herein, other aspects and implementations will be apparent to those skilled in the art from consideration of the specification disclosed herein. It is intended that the specification and illustrated implementations be considered as examples only, with a true scope and spirit of the following claims.

What is claimed:

**1**. A system for allowing a customer to deposit a check using a customer's own handheld mobile device, the system including:

a customer's handheld mobile device including a downloaded app, the downloaded app associated with a bank and causing the customer's handheld mobile device to:
- receive input entered by the customer indicating an amount of the check;
- use a display of the customer's handheld mobile device to assist the customer in having a digital camera take a photo of the check;
- assist the customer as to an orientation for taking the photo; and
- using a wireless network, transmit a copy of the photo over the Internet from the customer's handheld mobile device to the bank;

a bank computer programmed to:
- check for errors in the check in the photo by:
  - performing optical character recognition on the check in the photo to determine an amount shown on the check, and
  - comparing the amount shown to the amount entered by the customer; and

the system being configured to update a balance of an account after determining that no errors were found in the check in the photo.

**2**. The system of claim **1**, wherein the bank computer is configured to confirm that mobile deposit of the check can proceed after duplicate detection is performed on the check in the photo.

**3**. The system of claim **2**, wherein the system is configured to initiate the mobile deposit of the check after bank computer confirms that the mobile deposit can proceed.

**4**. The system of claim **1**, wherein the system is configured to perform the update the balance after it is determined that a mark or signature is present in an endorsement location in the photo of a back side of the check.

**5**. The system of claim **1**, wherein use of the display of the customer's handheld mobile device to assist the customer includes instructing the customer to have the digital camera take a photo of a front side of the check and a photo of a back side of the check.

**6**. The system of claim **1**, wherein the system is configured to convert the photo into a bi-tonal Tag Image File Format (TIFF).

**7**. The system of claim **1**, wherein the customer's handheld mobile device further includes camera software that controls a customer's digital camera, the camera software being separate from the downloaded app, the downloaded app at least partially controlling the camera software.

**8**. The system of claim **1**, wherein the downloaded app manages taking the photo.

**9**. The system of claim **1**, wherein the downloaded app instructs the customer to place the check in front of the digital camera before taking the photo.

**10**. The system of claim **1**, wherein the system is configured to generate a log file for the mobile deposit of the check, wherein the log file includes an image of the check submitted for mobile deposit of the check.

**11**. The system of claim **1**, wherein the copy of the photo is a modified version of the photo taken with the digital camera.

**12**. The system of claim **11**, wherein the copy of the photo has a different format than the photo taken with the digital camera.

**13**. The system of claim **1**, further comprising a third-party vendor computer.

**14**. A system for allowing a customer to deposit a check using a customer's own handheld mobile device with a digital camera, the system configured to authenticate the customer using data representing a customer fingerprint, the system including:

a customer's handheld mobile device including:
- camera software that controls the digital camera; and
- a downloaded app associated with a bank to control the camera software and to control submitting a check for deposit by causing the customer's handheld mobile device to perform the following steps:
  - instructing the customer to have the digital camera take photos of front and back sides of the check;
  - using a display of the customer's handheld mobile device to assist the customer in having the digital camera take the photos of the check;
  - assisting the customer as to an orientation for taking the photos;
  - receiving input from the customer indicating an amount of the check; and
  - using a wireless cellular network, transmitting a copy of the photos over the Internet from the customer's handheld mobile device and submitting the check for mobile check deposit in the bank after the photos of the check are presented to the customer;

a computer associated with the bank programmed to update a balance of an account to reflect the check submitted for mobile check deposit by the customer's handheld mobile device; and

the system configured to perform additional steps including:
- confirming that the mobile check deposit can go forward after optical character recognition is performed on the check, the optical character recognition determining an amount of the check, performing duplicate detection, and comparing the determined amount to the amount indicated by the customer; and
- generating a log file for the mobile check deposit, the log file including an image of the check submitted for mobile check deposit.

15. The system of claim 14, wherein the digital camera is separate from the customer's handheld mobile device.

16. The system of claim 14, wherein the customer's handheld mobile device is a Personal Digital Assistant (PDA).

17. A system for allowing a customer to deposit a check using a customer's own handheld mobile device, the system including:

a bank computer programmed to update a balance of an account to reflect an amount of a check submitted for mobile check deposit by the customer's handheld mobile device, the customer's handheld mobile device including a downloaded app, the downloaded app associated with a bank and causing the customer's handheld mobile device to perform:

receiving input entered by the customer indicating an amount of the check;

using a display of the customer's handheld mobile device to assist the customer in having a digital camera take a photo of the check,

assisting the customer as to an orientation for taking the photo, and

after taking the photo, using a wireless network, transmitting a copy of the photo over the Internet from the customer's handheld mobile device and submitting the check for mobile check deposit in the bank; and

the system being configured to update the balance of the account after optical character recognition reads a Magnetic Ink Character Recognition (MICR) line of the check in the photo.

18. The system of claim 17, wherein the digital camera is separate from the customer's handheld mobile device.

19. The system of claim 17, wherein the downloaded app manages taking the photo.

20. The system of claim 17, wherein the system is configured to generate a log file for the mobile check deposit, wherein the log file includes an image of the check submitted for mobile check deposit.

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