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(54) **SYSTEMS AND METHODS FOR
DETERMINING PLAYER PARTICIPATION
AT GAMING TABLES**

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See application file for complete search history.

(71) Applicant: **LNW Gaming, Inc.**, Las Vegas, NV
(US)

(72) Inventors: **Matthew J. Lucchetti**, Las Vegas, NV
(US); **Michael Vizzo**, Las Vegas, NV
(US)

(73) Assignee: **LNW Gaming, Inc.**, Las Vegas, NV
(US)

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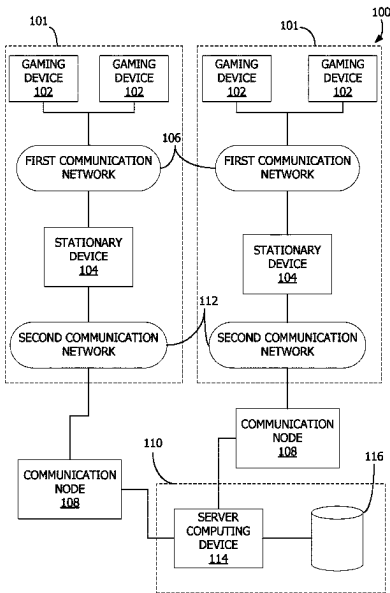
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(57) **ABSTRACT**

A system includes a plurality of stationary gaming tables positioned at a plurality of respective locations, a moveable table game device, one or more processors, and a server. Each gaming table includes a table transceiver and a table controller. The table game device includes a device transceiver that sends and receives data signals including operational data from the table transceivers via a first communication network. The server collects the operational data via a second communication network and stores the operational data for analysis, in particular, to obtain player participation data. The system, via the device transceiver and the table transceiver, may configure the moveable table game device according to configuration data stored in the memories of the table controller or the server by a configured moveable table game device previously located at the gaming table.

20 Claims, 7 Drawing Sheets



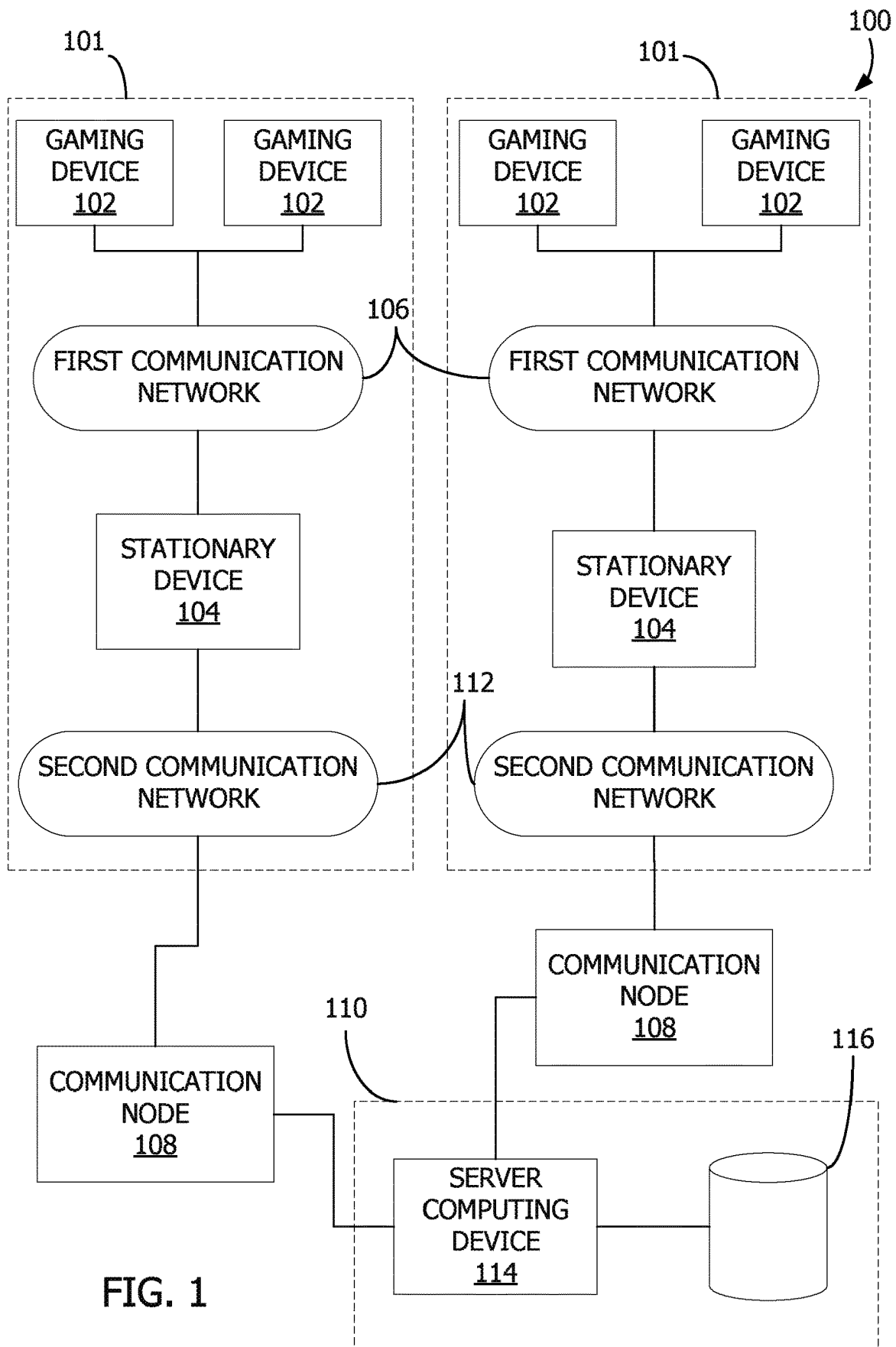
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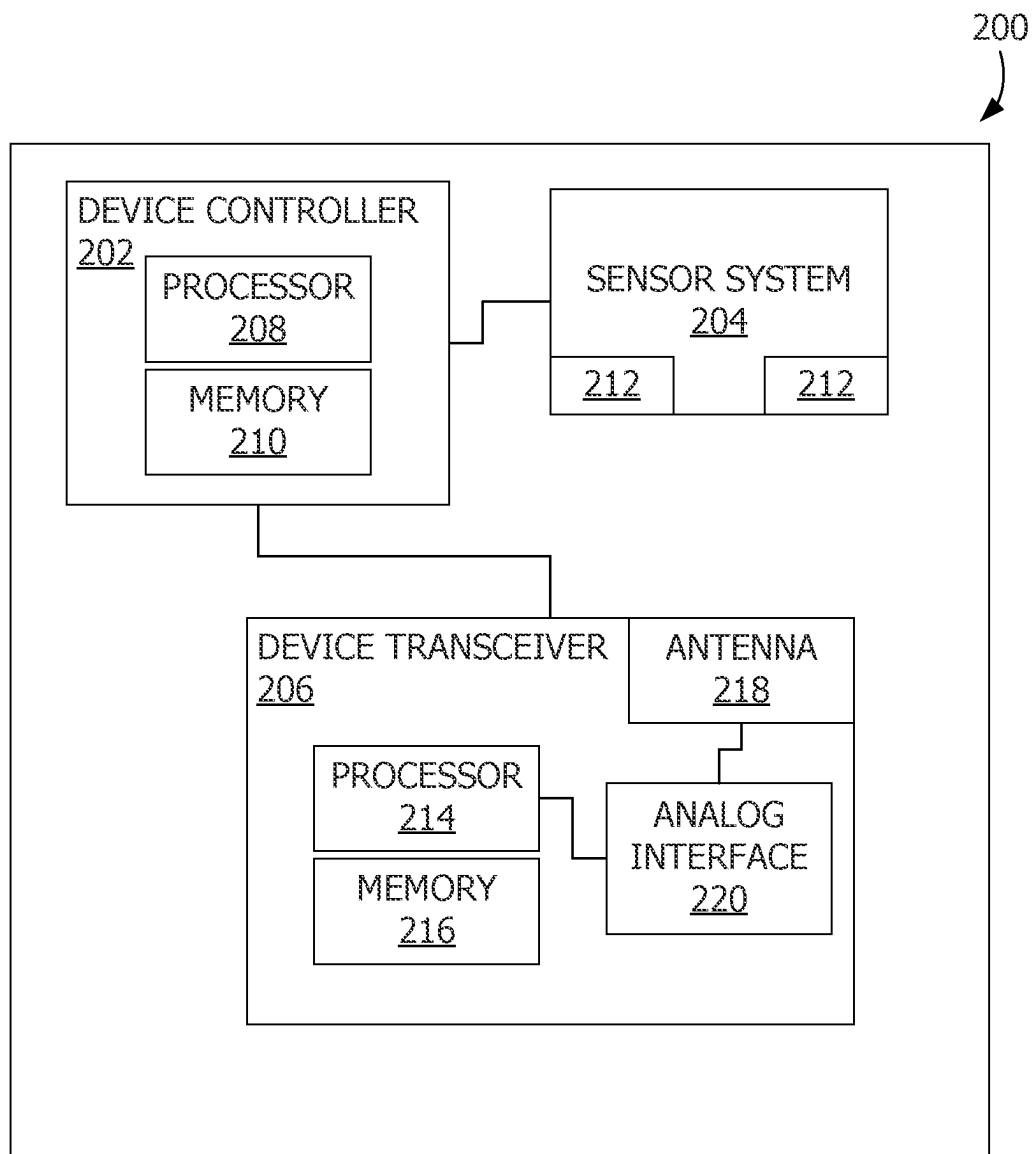


FIG. 2

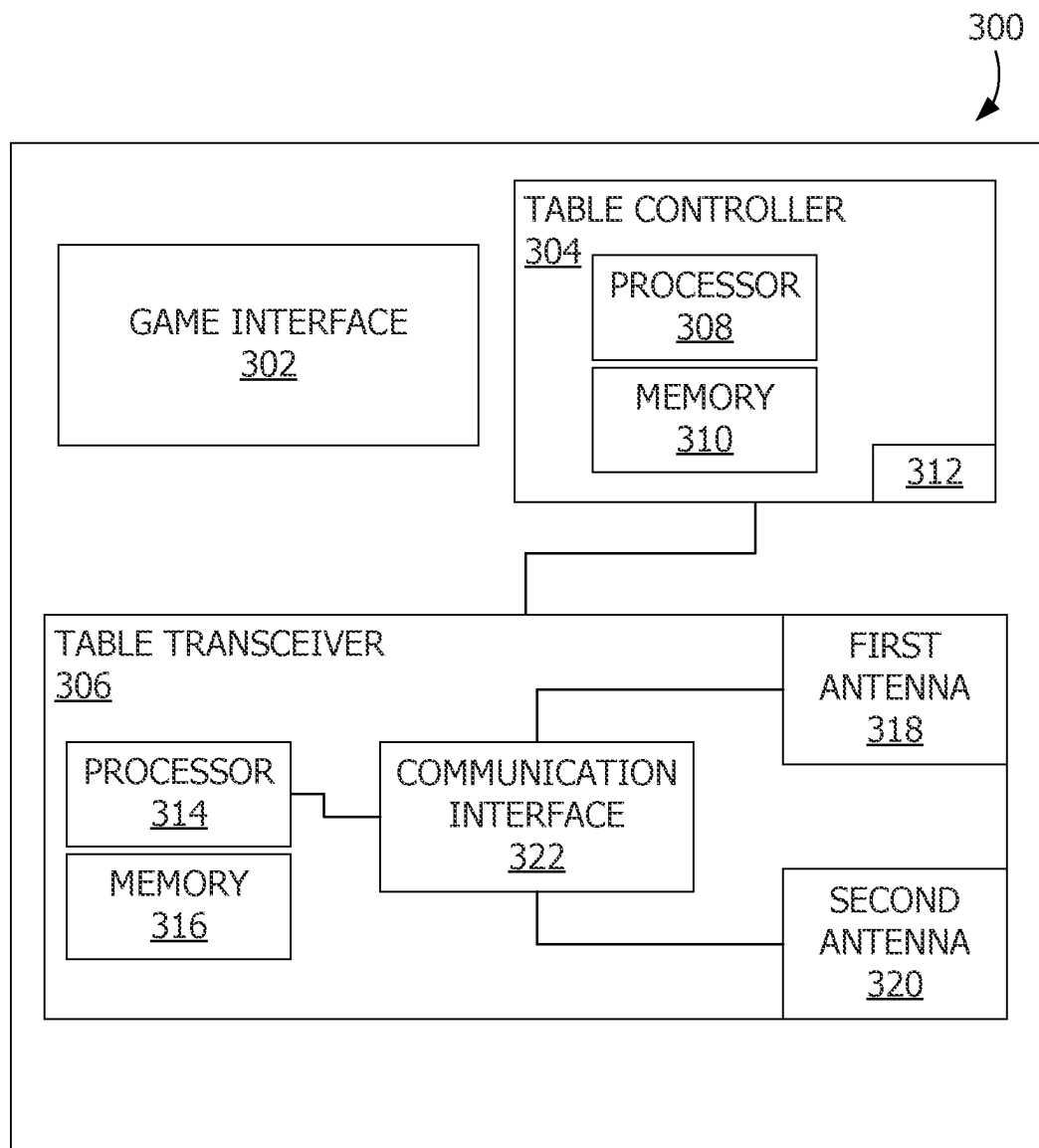
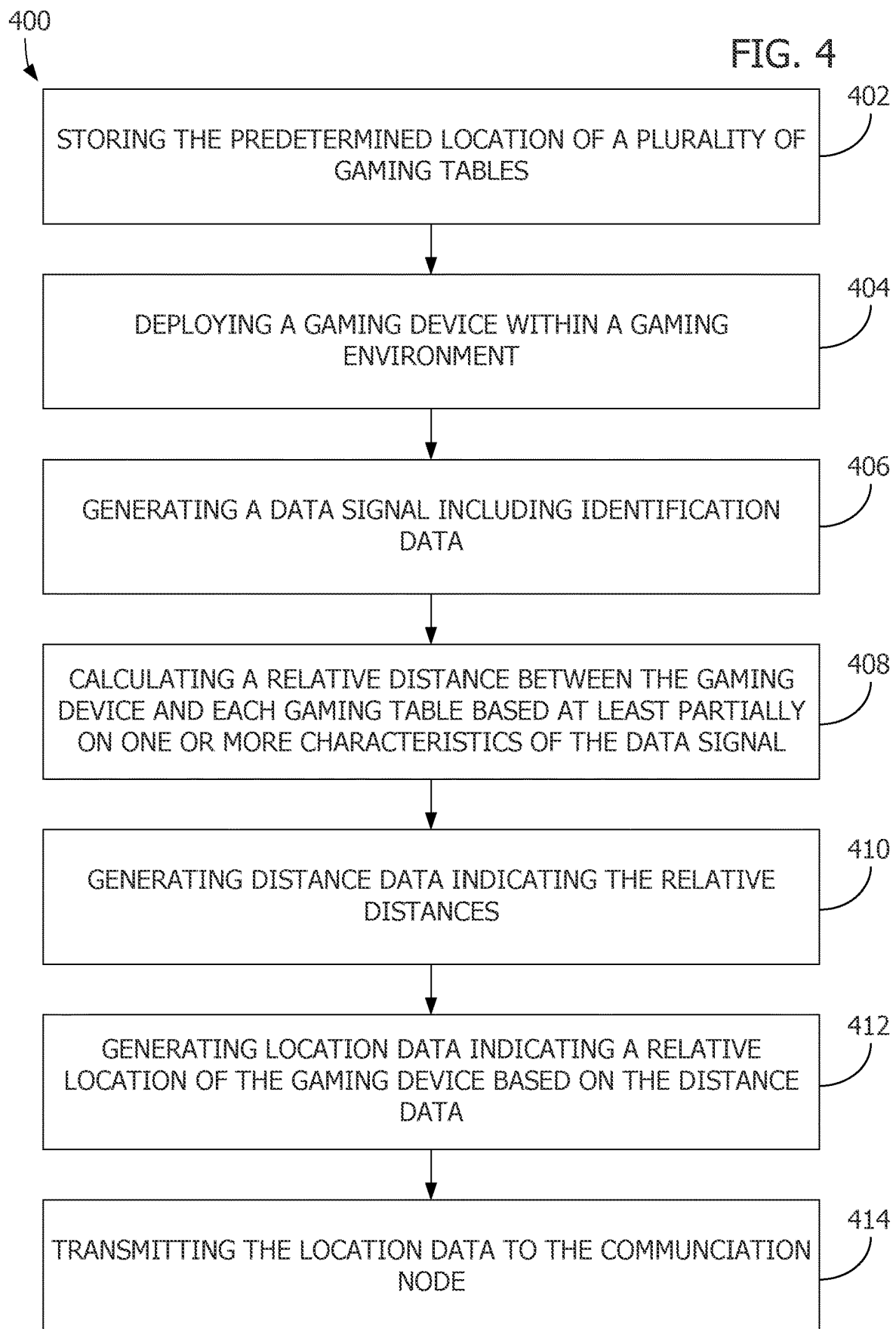


FIG. 3



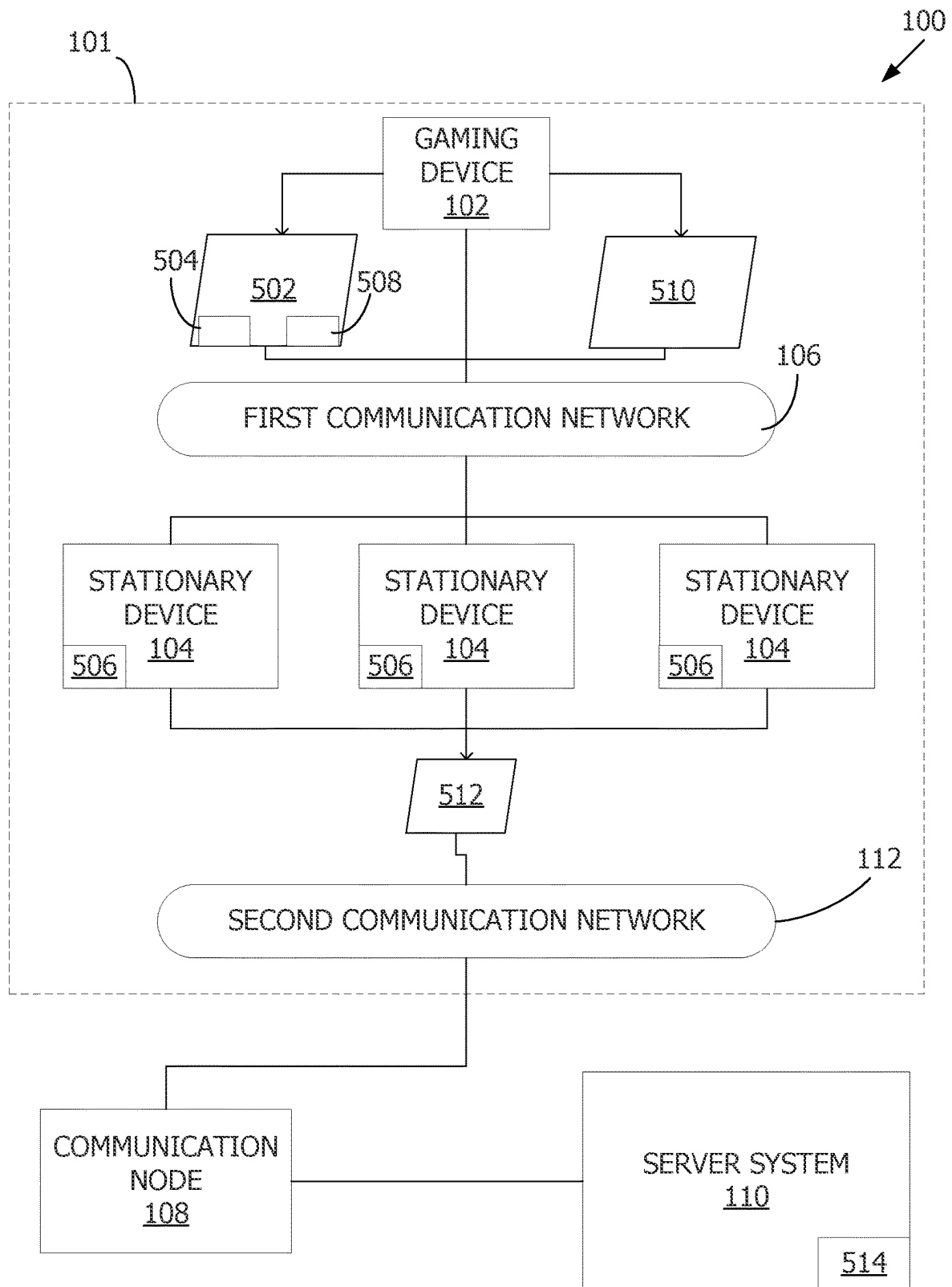


FIG. 5

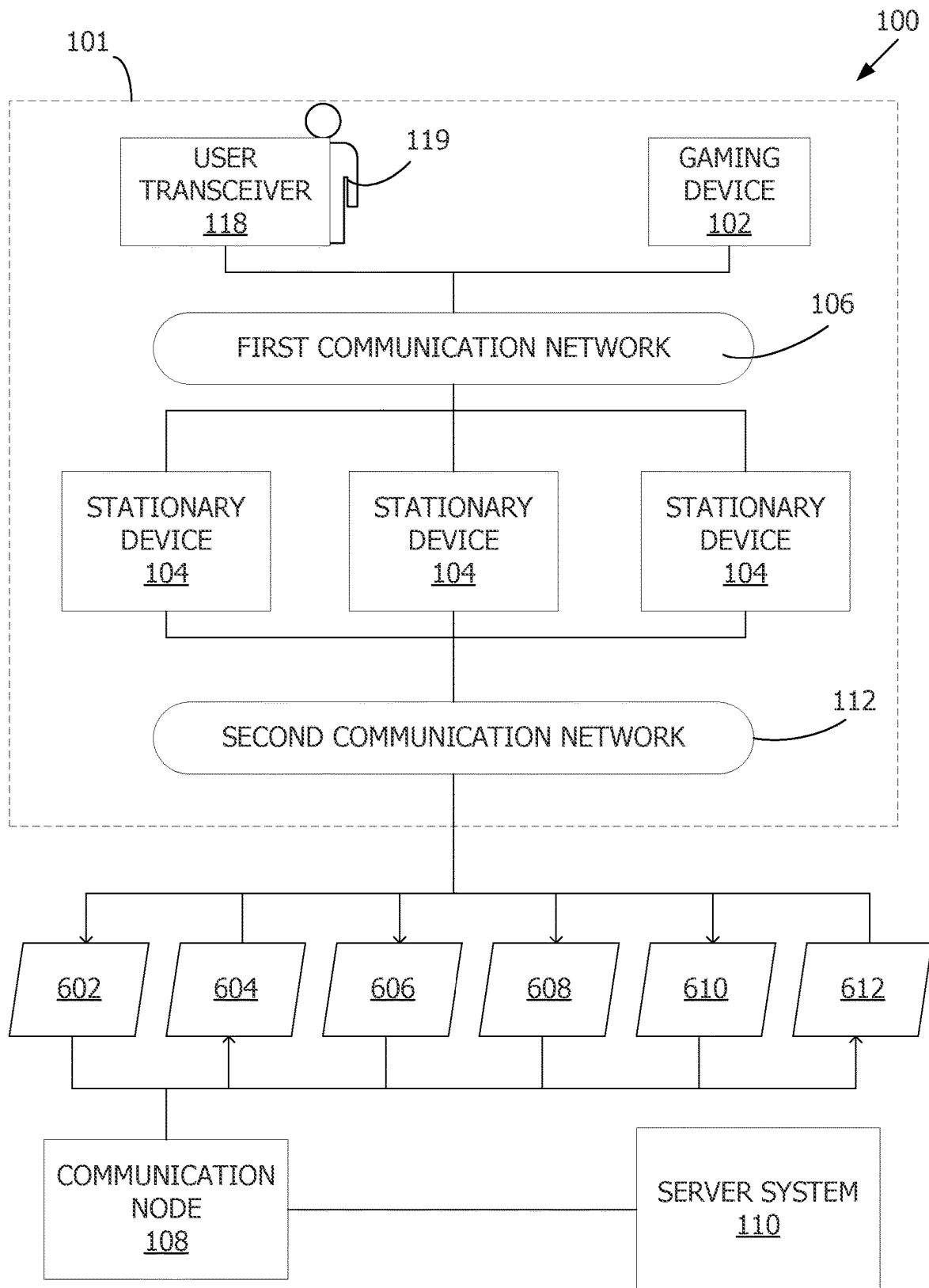
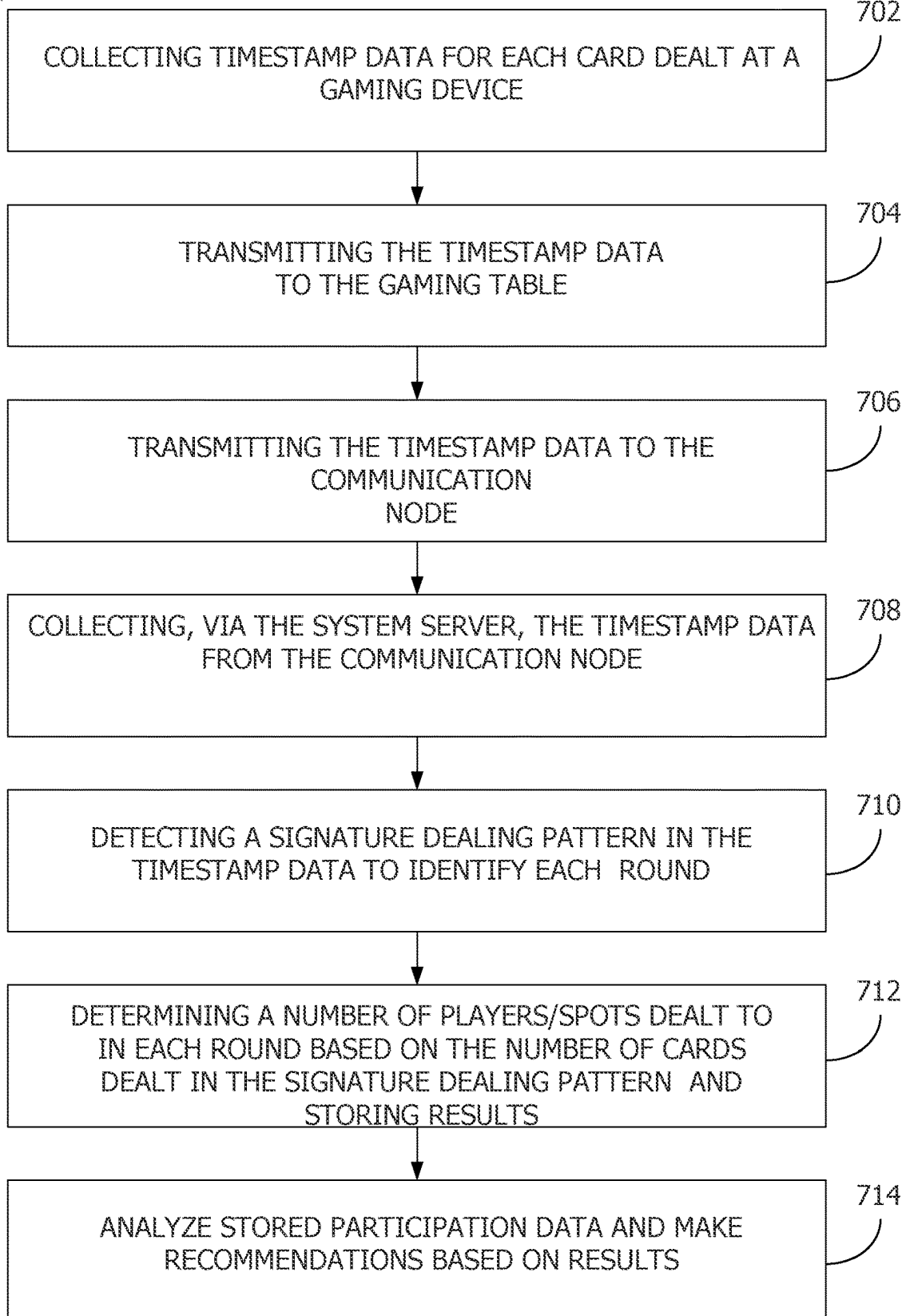


FIG. 6

700

FIG. 7



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SYSTEMS AND METHODS FOR DETERMINING PLAYER PARTICIPATION AT GAMING TABLES

RELATED APPLICATIONS

This application claims priority benefit to U.S. Provisional Patent Application No. 63/392,622, filed Jul. 27, 2022. This application also claims priority benefit to U.S. Provisional Patent Application No. 63/357,662 filed Jul. 1, 2022. Both of the above-referenced provisional patent applications are incorporated herein by reference in their entireties.

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TECHNICAL FIELD

This disclosure relates generally to networked gaming systems and, more specifically, to determining player participation at networked gaming devices within a gaming environment.

BACKGROUND

Gaming devices used in the gaming industry, such as electronic gaming machines (EGMs), card-handling devices, and the like, are used for increasing the efficiency, security, and game speed in games such as blackjack, baccarat, poker, and reel-based games. The gaming devices are deployed in a gaming environment (e.g., a casino). At least some gaming devices generate and/or collect data associated with gameplay, device diagnostics, and/or the like. The gaming devices may be communicatively coupled to a network to store and analyze the data from the gaming devices using a centralized data processing system. Casinos make money from a house edge on every bet. The higher the turnover of bets, the more profit from the edge. A full table at a low limit (especially blackjack) makes very little money and can actually lose money. A table with only one or two players has a much higher bet turnover. Often, a casino will raise the minimum wagers at a table to reduce the number of players at the table to one or two players. However, players at tables ebb and flow. Some dealers deal faster than others, affecting the need to make a change at a particular table. Some games have a more complex decision structure than others. Achieving a balance between entertainment value for players and profitability can be a daunting task. Estimating the average number of players and the number of hands per hour played at a variety of games with different rules and numbers of decks of cards can be overwhelming for gaming pit personnel responsible for a myriad of other tasks including general customer service, monitoring dealers and players for cheating, resolving payment disputes, and the like. Decisions to increase or decrease table limits, to open or close particular gaming tables, or to change the type of game played at each gaming table should be driven by analysis of player participation data that is as accurate and as timely as possible. Having real-time information on the number of

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players participating in rounds of play at the various gaming tables in a gaming establishment can help a casino fine-tune its advantage at any given moment. In some cases, table limits can be automatically adjusted, or tables may be automatically opened or closed based on such real time data.

SUMMARY

A system includes a plurality of stationary gaming tables positioned at a plurality of respective locations, a moveable table game device, one or more processors, and a server. Each gaming table includes a table transceiver and a table controller. The table game device includes a device transceiver that sends and receives data signals including operational data from the table transceivers via a first communication network. The server collects the operational data via a second communication network and stores the operational data for analysis, including the determination of player participation data.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram of an example networked gaming device system according to at least one embodiment.

FIG. 2 is a block diagram of an example gaming device according to at least one embodiment.

FIG. 3 is a block diagram of an example gaming table according to at least one embodiment;

FIG. 4 is a flow diagram of an example method for locating gaming devices using a networked gaming device system in accordance with at least one embodiment;

FIG. 5 is a data flow block diagram of the method shown in FIG. 4;

FIG. 6 is a data flow block diagram of data transmitted and generated by a networked gaming device system in accordance with at least one embodiment; and

FIG. 7 is a flow diagram of an example method for determining player participation in a blackjack game at a networked gaming device system in accordance with at least one embodiment.

The figures depict various embodiments for purposes of illustration only. One skilled in the art who also has the benefit of this disclosure may recognize from the following discussion that alternative embodiments of the structures and methods illustrated herein may be employed without departing from the principles described herein.

DETAILED DESCRIPTION

The present disclosure illustrates, in various embodiments, systems and methods of locating and communicating with networked, moveable gaming devices.

In the following description, circuits and functions may be shown in block diagram form in order not to obscure the descriptions in unnecessary detail. Conversely, specific circuit implementations shown and described are examples only and should not be construed as the only way to implement networked gaming devices unless specified otherwise herein. Additionally, block definitions and partitioning of logic between various blocks illustrates one possible embodiment. It may become apparent to one of skill in the art, who also has the benefit of this disclosure, that the embodiments disclosed may be practiced by various other partitioning solutions, all of which are contemplated herein.

Further, the term “module” is used herein in a non-limiting sense to indicate functionality of particular circuits and/or assemblies within embodiments of networked gam-

ing device systems and is not to be construed as requiring a particular physical structure, or particular partitioning between elements for performing the indicated functions.

When executed as firmware or software, the instructions for performing the methods and processes described herein may be stored on a computer readable medium. A computer readable medium includes, but is not limited to, magnetic and optical storage devices such as disk drives, magnetic tape, CDs (compact discs), DVDs (digital versatile discs or digital video discs), and semiconductor devices such as RAM, DRAM, ROM, EPROM, and Flash memory.

The processors described herein process data signals and may comprise various computing architectures such as a complex instruction set computer (CISC) architecture, a reduced instruction set computer (RISC) architecture, or an architecture implementing a combination of instruction sets. Although only a single processor may be shown, multiple processors may be included. The processors comprise an arithmetic logic unit, a microprocessor, a general-purpose computer, or some other information appliance equipped to transmit, receive, and process electronic data signals from an associated memory and/or one or more input/output devices.

The memory described herein stores instructions and/or data that may be executed and/or accessed by the associated processor. The instructions and/or data may comprise code for performing any and/or all of the techniques described herein. The memory may be a dynamic random-access memory (DRAM) device, a static random-access memory (SRAM) device, Flash RAM (non-volatile storage), combinations of the above, or some other memory device known in the art. While the memory may be shown within some devices, some of the memory can be remote, e.g., on a separate device connected to the device or via a WAN, e.g., a cloud-based storage device.

As used herein, a “gaming device” or “game device” refers to an apparatus associated with one or more aspects of a gaming environment. For example, a gaming device may include card-handling devices (e.g., shufflers and shoes), electronic gaming machines (EGMs), and/or other devices that provide gameplay features for a game. Gaming devices may also include devices that are not directly involved in gameplay, such as information kiosks, displays, currency conversion devices, and the like. The foregoing examples of gaming devices are for exemplary purposes only and do not limit the gaming devices to the examples mentioned above.

As used herein, a “gaming environment” or “casino environment” is a location or multiple locations in which one or more games (particularly, wagering games) are conducted. Although some gaming environments may not include any gaming devices, in the embodiments described herein, at least one gaming device is deployed at the gaming environment to facilitate play of the one or more games.

The systems and methods described herein facilitate data communication with, and location tracking of, networked gaming devices. These gaming devices may be moveable within and outside of one or more gaming environments to enable operators of the gaming environments to customize the gaming environments and remove the gaming devices from the gaming environments for maintenance. In the systems and methods described herein, each gaming device includes a device transceiver for data communication over a first communication network. The gaming environment includes one or more stationary devices, such as stationary gaming tables, that have transceivers that communicatively couple to the device transceivers of the gaming devices to exchange gaming data via the first communication network. The transceivers are further communicatively coupled to a

server via a second communication network to enable the server to collect the gaming data from the gaming devices and the stationary devices for analysis and historical storage.

In the systems and methods described herein, the stationary devices have a known or predetermined location within the gaming environment. The device transceivers, the transceivers of the stationary devices, and/or other computing modules associated with the gaming devices or stationary devices monitor data signals transmitted between each gaming device and each stationary device to calculate a relative distance measurement between the gaming device and the stationary device. The distance data associated with a gaming device is collected and analyzed by the gaming device to determine its location relative to the stationary devices. The location data generated by the gaming devices may be collected by the server to facilitate centralized storage and analysis of the location data. Based on the location data, the server may automatically determine which gaming devices are active, what game that the gaming devices are being used for, which gaming environment the gaming devices are located in, and/or other data relevant to the device location.

The technical problems addressed by the systems and methods described herein may include, for example: (i) data network congestion from transmitting gaming data over populated network channels; (ii) imprecise location determinations of gaming devices and users within gaming environments; (iii) manual configuration of game devices for a particular game; (iv) imprecise usage data collection for gaming devices; and (v) reactive maintenance of gaming device malfunctions.

The technical solutions that may be provided by the systems and methods described herein may include, for example: (i) reduced data network congestion by using network channels other than the populated network channels and frequency bands; (ii) improved precision of locating gaming devices and users within gaming environments; (iii) automated configuration of game devices for a particular game; (iv) improved usage data collection for gaming devices; (v) proactive maintenance of gaming devices to reduce the frequency of device malfunctions; and (vi) reduced cost and complexity of transceivers by consolidating data communication and location services using the same communication network.

FIG. 1 is a block diagram of an example networked gaming device system 100 for use within one or more gaming environments 101. The system 100 includes one or more gaming devices 102, a plurality of stationary devices 104, a first network 106, one or more communication nodes 108, a server system 110, and a second communication network 112. In other embodiments, the system 100 may include additional, fewer, or alternative subsystems, including those described elsewhere herein.

The gaming devices 102 are moveable devices configured to facilitate play of games within the gaming environments 101. In the example embodiment, the gaming devices 102 are deployed in two gaming environments, e.g., two casinos. In other embodiments, the gaming devices 102 may be deployed to a different number of gaming environments (including one).

FIG. 2 is a block diagram of an example gaming device 200 that may be used with a networked gaming device system, such as the system 100. The gaming device 200 includes a device controller 202, a sensor system 204, and a device transceiver 206. In other embodiments, the gaming device 200 may include additional, fewer, or alternative components, including those described elsewhere herein.

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The device controller **202** is configured to monitor and/or control operation of the gaming device **200**. The device controller **202** includes one or more processors **208** and associated memory **210**. The memory **210** stores computer-readable instructions that, when executed by the processors **208**, cause the device controller **202** to function as described herein. For example, when the gaming device **200** is a card-handling device, the device controller **202** may be configured to cause the gaming device **200** to receive cards from a dealer, shuffle the cards, and output the shuffled cards to the dealer for use in a card-based game (e.g., poker or blackjack).

The sensor system **204** includes one or more sensors **212** that are configured to collect sensor data associated with the gaming device **200**. For example, the sensor system **204** of a card-handling device may include one or more image sensors to capture images of each card passing through a portion of the card-handling device. In another example, the sensor system **204** may include one or more sensors to identify user input and/or credit inputs (e.g., bills, coins, tickets, etc.) from a player. The sensors **212** may be configured to collect any suitable sensor data associated with the gaming device **200** and/or the environment surrounding the gaming device **200**, such as motion data, image data, strain data, pressure data, temperature data, usage data, maintenance-related data, and the like. In the example embodiment, the sensor system **204** is communicatively coupled to the device controller **202** to transmit the sensor data. In certain embodiments, the sensor system **204** is communicatively coupled to the device transceiver **206** to transmit the sensor data. Alternatively, the gaming device **200** may not include the sensor system **204**.

The device transceiver **206** is communicatively coupled to the device controller **202** and the first communication network **106** (shown in FIG. 1). Although the device transceiver **206** is shown within the gaming device **200**, in some embodiments, the device transceiver **206** may be positioned externally from the device **200**, such as an add-on or after-market device. In such embodiments, the device transceiver **206** may be communicatively coupled to the controller **202** via wired, contact and/or wireless communication. For example, the device **200** may include one or more data ports or antenna to connect to the device transceiver **206**. In the example embodiment, the device transceiver **206** includes one or more transceiver processors **214**, associated memory **216**, an antenna **218**, and an analog interface **220**. In some embodiments, the device transceiver **206** includes additional, fewer, or alternative components, including those described elsewhere herein. For example, the device transceiver **206** may include a power storage device (e.g., a battery) to facilitate operation while the device controller **202** is inactive. Similarly, the device transceiver **206** may be configured to operate in a low-power mode to function as described herein while the device controller is inactive. In other embodiments, the device transceiver **206** is at least partially integrated with the device controller **202**. In one example, the transceiver processors **214** and/or the memory **216** are part of the processors **208** and the memory **210**, respectively. In such an example, the processes and functions of the transceiver processors **214** and the memory **216** may be implemented as dedicated modules or applications within the processors **208** and the memory **210**. In another example, each component of the device transceiver **206** is included within the device controller **202**.

The device transceiver **206** is configured to communicate data associated with the gaming device **200** to and from the first communication network **106** and determine the relative

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location of the gaming device **200** as described in detail herein. In particular, the device transceiver **206** is configured to communicate data in accordance with the communication protocols of the first communication network **106**. In one example, the first communication network **106** is an ultra-wideband communication network. Ultra-wideband communication, unlike some common types of wireless communication (e.g., Wi-Fi and Bluetooth), is not restricted to heavily populated frequency bands (e.g., 2.4 GHz and 5 GHz). Rather, ultra-wideband communication may be performed at other, less-populated, frequency bands that still provide relatively high data speeds. In one example, the ultra-wideband network may be configured to facilitate communication at a plurality of frequency bands from 3.5 GHz to 6.5 GHz with data rates of 110 kbps, 850 kbps, or 6.8 Mbps. In addition, in comparison to wired communication networks, wireless communication using ultra-wideband facilitates improved portability of the gaming device **200** and increased flexibility for arranging the device **200** within a gaming environment without concern of wire access points and the like. In other embodiments, other suitable types of communication networks that avoid populated or saturated frequency bands may be used for the first communication network **106**.

In the example embodiment, the first communication network **106** is a non-persistent communication network. That is, unlike Wi-Fi, which uses routers to maintain a persistent communication signal for connecting devices to the Wi-Fi network, each device communicatively coupled to the network **106** includes a transceiver (e.g., the device transceiver **206**) for discovering and establishing communication with other devices. In other embodiments, the first communication network **106** is a persistent network.

The antenna **218** of the device transceiver **206** is configured to receive and transmit data signals with other devices via the first communication network **106**. In some embodiments, the device transceiver **206** may include more than one antenna **218**, such as one antenna **218** for receiving signals and another antenna **218** for transmitting signals. In the example embodiment, the data signals received and transmitted by the antenna **218** are analog signals. The analog interface **220** is communicatively coupled to the antenna **218** to convert received data signals to a digital format compatible with the transceiver processor **214** and to convert digital data signals from the processor **214** to an analog format for transmission via the first communication network **106**.

In at least some embodiments, the device transceiver **206** includes other components that facilitate the operation of the transceiver processor **214**, the antenna **218**, and/or the analog interface **220**, such as, but not limited to, clock generators, phase-lock-loop circuitry, state controllers, power supplies, power management circuitry, filter circuitry, communication interfaces with the device controller **202**, and the like. In some embodiments, the device transceiver **206** is powered separately from the device controller **202** to enable communication even if the gaming device **200** is in an inactive (i.e., powered-off) state. In such embodiments, the device transceiver **206** may enter a low-power mode while the gaming device is inactive to conserve power.

With respect again to FIG. 1, the stationary devices **104** are positioned around the gaming environment. Rather than being permanently fixed to a particular location (though some stationary devices **104** may be permanent fixtures), the stationary devices **104** are typically located at a single, predetermined location for a period of time (e.g., one hour, one day, one month, etc.). For example, the stationary

devices **104** may include, but are not limited to, gaming tables, building structural components (e.g., walls, stairs, ceiling panels, etc.), and/or other similar devices. Likewise, although the gaming devices **102** may be moveable or portable, the gaming devices **102** may remain stationary for an extended period of time. In some cases, a gaming device **102** may be deployed at a stationary device **104** until maintenance is required, and some gaming devices **102** may be moved together with the corresponding stationary device **104**. As an example, a card-handling device coupled to a gaming table may remain coupled to the table other than during periods of maintenance and may be relocated within a gaming environment together with the table.

For exemplary purposes herein, the stationary devices **104** are stationary gaming tables positioned within the gaming environment. However, the details described below with respect to the gaming tables **104** are not limited to gaming tables and may be applicable to other stationary devices. Moreover, in some embodiments, the stationary devices **104** may include a variety of different types of stationary devices.

FIG. 3 illustrates an example stationary gaming table **300** that may be used with a networked gaming device system, such as the system **100**. The gaming table **300** includes a game interface **302**, a table controller **304**, and a table transceiver **306**. In other embodiments, the gaming table **300** may include additional, fewer, or alternative components, including those described elsewhere herein.

The game interface **302** is an area of the gaming table **300** that is used for play of a game. For example, the upper felt surface including game symbols on a poker table is the game interface **302**. The game interface **302** may be configured to include one or more gaming devices (e.g., the gaming devices **102**, shown in FIG. 1) and/or other devices that facilitate play of a game. In one example, the game interface **302** includes one or more displays, lights, and/or input devices for a game.

The table controller **304**, similar to the device controller **202** shown in FIG. 2, is configured to monitor and/or control operation of one or more devices associated with the gaming table **300**, including the table **300** itself in some embodiments. The table controller **304** includes one or more table processors **308** and associated memory **310** for executing computer-readable instructions to perform the functions of the table controller described herein. The table controller **304** may be configured to coordinate the various devices associated with the gaming table to provide consistent gameplay of the game. For example, if the gaming table **300** includes individual displays for each player, the table controller **304** may be configured to cause each display to display information relevant to the respective players.

In the example embodiment, the table controller **304** includes one or more sensors **312** for collecting sensor data. The sensors **312** may include, but are not limited to, image sensors, pressure sensors, light sensors, audio sensors, and the like. The table controller **304** may analyze the sensor data to determine the state of the game, gaming devices, operators, and/or players associated with the gaming table **300**.

The table transceiver **306** is physically coupled to the gaming table **300** and is configured to communicate with the first communication network **106** and the second communication network **112** (both shown in FIG. 1). The table transceiver **306** is further communicatively coupled to the table controller **304** to facilitate communication between the table controller **304** and the first and/or second communication networks **106**, **112**. In other embodiments, the table

controller **304** may be separate and independent from the table transceiver **306**. In the example embodiment, the table transceiver **306** includes one or more processors **314**, associated memory **316**, a first antenna **318**, a second antenna **320**, and a communication interface **322**. The memory **316** stores instructions that, when executed by the processors **314**, cause the device transceiver to function as described herein. In other embodiments, the table transceiver **306** may include additional, fewer, or alternative components, including those described elsewhere herein.

In some embodiments, the table controller **304** and the table transceiver **306** may be at least partially integrated with each other. For example, the table processors **308** and the memory **310** may be integrated with the processor **314** and the memory **316**, respectively. As another example, the sensors **312** may be incorporated with the table transceiver **306**. In other embodiments, the gaming table **300** does not include a table controller **304**, and the table transceiver **306** operates independently. In such embodiments, the gaming table **300** may not include devices controllable by the controller **304** or the devices are configured to operate without control from the table controller **304**.

The first antenna **318** is configured to transmit and receive data signals via the first communication network **106**, whereas the second antenna **320** is configured to transmit and receive data signals via the second communication network **112**. The antennae **318**, **320** may include more than one antenna each to facilitate communication. In certain embodiments, a single antenna may be used to communicate with both the first and second communication networks **106**, **112**. The communication interface **322** is communicatively coupled to the antennae **318**, **320** to convert data signals between analog and digital formats and perform any other suitable functions to facilitate communication. In certain embodiments, the table transceiver **306** may be divided into separate modules for communication with the first communication network **106** and the second communication network **112**. That is, at least the antennae **318**, **320** may be separated into different physical modules. The processors **314**, the memory **316**, and/or the communication interface **322** may be divided between the separate modules. In at least some embodiments, the table transceiver **306** may include other components and subsystems to facilitate the functions described herein. For example, the table transceiver **306** may include circuitry for power supply, power management, signal filtration, state management, other network interfaces, and/or other suitable functionality.

With respect to both FIGS. 1 and 3, the second communication network **112** is configured to facilitate communication with a plurality of gaming tables **300** and other stationary devices using a reduced number of communication nodes **108**. That is, the second communication network **112** is configured for relatively long-range, low interference communication to enable one or more communication nodes **108** to communicate with a plurality of gaming tables **104** deployed throughout a gaming environment. In addition, similar to the first communication network **106**, the second communication network **112** is configured to facilitate communication outside of the commonly populated frequency bands to avoid signal interference. The second communication network **112** may be a different type of network and/or use a different frequency band in comparison to the first communication network **106**. In the example embodiment, the second communication network **112** is a Long Range (LoRa) communication network. LoRa networks communicate using radio signals having frequencies below 1 GHz to facilitate relatively long communication ranges, relatively

low power consumption, and/or other network features, such as end-to-end encryption and relatively high communication bandwidth. The use of a wireless second communication network 112 facilitates increased flexibility in deploying the gaming tables throughout a gaming environment, and the use of a LoRa network with a relatively large communication range reduces the number of communication nodes 108 that need to be deployed to communicate with the gaming tables 300. In other embodiments, other suitable types of networks may be used as the second communication network 112. Alternatively, the second communication network 112 may be integrated with the first communication network 106.

The communication node 108 is a network interface communicatively coupled to the server system 110 and the second communication network 112 at a respective gaming environment 101. The communication node 108 facilitates communication between the gaming tables 104 and the server system 110 for data transmission, locating gaming devices 102 within the gaming environments 101, and the like. The communication node 108 may include any suitable network components to communicate with both the second communication network 112 and the server system 110. For example, the communication node 108 may include a transceiver configured to transmit data signals in accordance with the protocols of the second communication network 112. In another example, the communication node 108 may be communicatively coupled with the server system 110 via any form of wireless or wired connections or any combination thereof. By way of example and not limitation, communication between the communication node 108 and the server system 110 may be comprised of serial data links, parallel data links, USB, Ethernet, a Wide Area Network (WAN), a Local Area Network (LAN), infrared communication, IEEE 802.16 (or WiMax), IEEE 802.11a/b/g/n/p, Wi-Fi, and any public cellular phone network including, but not limited to, GSM, CDMA, 3G, or 3GPP Long Term Evolution (LTE), communication, etc.

In the example embodiment, each gaming environment 101 includes one communication node 108 for communicating with the gaming tables 104 at the respective gaming environment 101. In other embodiments, a plurality of communication nodes 108 may be configured to communicate with the second communication network 112 at a single gaming environment 101. Alternatively, a communication node 108 may be configured to communicate with the second communication network 112 over multiple gaming environments 101. In certain embodiments, the communication node 108 may be configured to communicatively couple to the first communication network 106 in addition to or instead of the second communication network 112. In such embodiments, the communication node 108 may communicate with the gaming devices 102 and/or the gaming tables 104 via the first communication network 106. In one example, the communication node 108 is configured to communicate with relatively nearby devices 102 and/or tables 104 via the first communication network 106 (i.e., devices and tables within the effective communication range of the communication node 108 using the first communication network) and to communicate with other tables 104 via the second communication network 112 that has a greater effective communication range than the first communication network 106.

The server system 110 includes one or more server computing devices 114 and a server database 116. The server system 110 may be centralized (i.e., the server computing device 114 and the server database 116 are integrated with

each other) or distributed. The server system 110 is configured to collect data from the gaming devices 102 and the gaming tables 104 via the communication node 108 and the second communication network 112, analyze the data, and/or store the data. In one example, the server system 110 monitors usage of the gaming devices 102 within the gaming environments 101. In another example, the server system 110 determines a location of each deployed gaming device 102 as described herein.

The server computing device 114 is configured to execute at least a portion of the tasks performed by the server system 110 as described herein, such as requesting data from the gaming tables 104, analyzing the data from the gaming tables 104, and storing data within the server database 116. In the example embodiment, the server computing device 114 is configured to receive data indicating a relative location of each gaming device 102 for storage and analysis of the location data. In certain embodiments, the server computing device 114

The server database 116 is configured to store data generated by the server system 110 and/or data collected from the gaming tables 104. In some embodiments, the server database 116 is formed by a plurality of distributed databases. In one example, the server database 116 is configured to store data collected from the gaming tables 104, game settings associated with one or more games, usage data for each gaming device 102, reports generated by the server computing device 114, and/or a dynamic map indicating a location of each gaming device 102 within the gaming environments 101.

FIG. 4 is a flow diagram of an example method 400 of locating a gaming device 102 within a gaming environment 101 using the networked gaming device system 100. FIG. 5 is a data flow diagram 500 of the method 400 using the networked gaming device system 100. The method 400 may be used to locate a plurality of gaming devices 102 within multiple gaming environments 101 to provide a dynamic map of where each device 102 is located, if the device 102 is active (i.e., in use), and/or what gaming table 104 is associated with each device 102. In other embodiments, the method 400 may include additional, fewer, or alternative steps, including those described elsewhere herein. Moreover, at least some of the steps described herein performed by the gaming device 102, the gaming tables 104, the communication node 108, and/or the server system 110 may be performed using one or more computing devices and/or processors, such as the computing devices and processors described above with respect to FIGS. 1-3.

In the example embodiment, with respect to both FIGS. 4 and 5, the gaming tables 104 are deployed within a gaming environment 101 and establish communication with the communication node 108. The gaming tables 104 have a predetermined location within the gaming environment 101. The location may be provided as, for example, geographical coordinates, coordinates within a map of the gaming environment 101 (and any surrounding areas), and/or other suitable forms of specifying location. In one example, a map of the gaming environment is divided into a grid, where each cell of the grid can be filled with a gaming table 104. In some embodiments, the predetermined location is identified and assigned to the gaming tables 104 manually. In other embodiments, the location of each gaming table 104 is determined automatically by the server system 110 and/or the respective gaming tables 104. In one example in which a gaming table 104 is communicatively coupled to at least three communication nodes 108 via a LoRa second communication network 112, the location of the gaming table

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104 may be determined as a function of the timestamps of a data signal generated by the transceiver of the gaming table 104 (e.g., table transceiver 306, shown in FIG. 3) and received by each communication node 108. The server system 110 stores 402 the predetermined location of each stationary gaming table 104 for the location determination described herein. Each stationary gaming table 104 may also store its respective location. In certain embodiments, each gaming table 104 may be associated with one or more games to be played at the gaming table 104. That is, a gaming table 104 is assigned one or more games and, in some embodiments, game settings may be stored by the gaming table 104 for the games.

The gaming device 102 is then activated and deployed 404 within the gaming environment 101. Although each gaming table 104 is assumed to be within communication range of the gaming device 102 for exemplary purposes, other gaming tables 104 may be deployed outside of the communication range of the gaming device 102. When activated, the gaming device 102 is configured to receive 406 data signals 502 including identification data 504 from each gaming table 104 via the first communication network 106. The identification data 504 identifies the gaming table 104 from which the respective data signal 502 originates. The identification data 504 may include, but is not limited to, a unique identifier, a type of game, supported game device and/or other suitable data associated with the gaming table 104 that may be used to locate and configure the gaming device 102. The data signal 502 is received by the gaming device 102 and the identification data 504 is extracted to identify each gaming table 104. In at least some embodiments, the device transceiver and/or the controller of the gaming device 102 (e.g., device controller 202 and device transceiver 206, both shown in FIG. 2) automatically generates a timestamp 506 at the time that each data signal 502 was received. In at least some embodiments, the gaming device 102 is configured to generate the data signal 502 to be received by the gaming tables 104. In such embodiments, the gaming tables 104 are configured to generate the timestamps 506 for each received data signal 502. The data signal 502 may be generated by both the gaming device 102 and the gaming tables 104. For example, one gaming device 102 may receive data signals 502 from the gaming tables 104 and/or other gaming devices 102. In such embodiments, the gaming devices 102 may treat the data signals 502 from other gaming devices 102 similar to data signals from gaming tables 104 for purposes of determining location as described herein. Likewise, in another example, one stationary gaming table may receive data signals 502 from gaming devices 102 and/or other stationary gaming tables 104. In certain embodiments, the data signal 502 may be transmitted in response to a data signal received by the gaming device 102 or the gaming tables 104.

In the example embodiment, one or more characteristics of the data signal 502 may be used to calculate 408 a relative distance between the gaming device 102 and each of the gaming tables 104. The characteristics may include, but are not limited to, amplitude, phase, frequency, phase, time-of-transmission, time-of-flight, time-of-arrival, and/or signal intensity. In one example, if the first communication network 106 is an ultra-wideband network, the characteristic may preferably be a time-of-flight characteristic or a time-difference-of-arrival characteristic. In at least one example, the relative distance between the gaming device 102 and one of the gaming tables 104 is at least partially a function of the frequency of the data signal 502, the speed of light, and/or the time the data signal 502 was received (i.e., the timestamp

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506). In some embodiments, the gaming tables 104 generate a respective transmission timestamp 508 and include the transmission timestamps 508 with the respective data signals 502. The internal clocks of the gaming tables 104 may be synchronized to improve the accuracy of the timestamps 508. In such embodiments, the difference between the timestamp 506 at which the signal 502 was received and the transmission timestamp 508 indicates a relative distance between the gaming device 102 and the gaming table 104.

Unlike other types of communication networks, the use of the time-of-flight characteristic or the time-difference-of-arrival characteristic provides improved accuracy of the distance determination in comparison to methods relying upon signal strength, which may be impacted by various other factors beyond distance (especially in gaming environments populated with devices and structures that may impact signal strength). Synchronizing the internal clocks of the gaming device 102 and/or the gaming tables 104 facilitates increased precision in calculating the relative distances.

The gaming device 102 and/or the gaming tables 104 generate 410 distance data 510 indicating the calculated relative distances between the gaming device 102 and each gaming table 104. The distance data 510 may include, but is not limited to, a distance measurement, an identifier of the associated gaming table 104, the timestamp 506, the transmission timestamp 508, and/or other data that facilitates determining the relative distances to the gaming device 102. In some embodiments in which the gaming tables 104 generate the distance data 510, each gaming table 104 generates its respective distance data 510. Alternatively, the gaming device 102 may generate the distance data 510 for the gaming tables 104. In such embodiments, the gaming device 102 may transmit the distance data 510 to each respective gaming table 104.

In the example embodiment, the gaming device 102 collects the distance data 510 for at least a portion of the calculated distances. That is, in some embodiments, the gaming device 102 may filter out distances exceed a threshold distance to reduce computational burden of the location determination analysis described herein. In addition, the gaming device 102 collects the predetermined locations of the gaming tables 104. In certain embodiments, the locations are included within the identification data 504. In other embodiments, the locations are collected via other data signals received by the gaming device 102. The gaming device 102 is configured to determine its relative location within (or near) the gaming environment 101.

The gaming system 102 compares the timestamps and/or distances of the distance data 510 with the predetermined locations of the gaming tables 104. Using trilateration or other suitable location-determination techniques, the location of the gaming device 102 is identified at least partially as a function of the distance data 510. For example, if the relative distances are calculated between the gaming device 102 and at least three gaming tables 104 while accounting for the known locations of the gaming tables, the gaming device 102 can determine the location of the gaming device 102 relative to the gaming tables 104. In comparison to location-determination techniques that use satellites, signal towers, and the like that are remotely located from the gaming environment 101 and susceptible to interference from other devices and structures, determining location relative to the gaming tables 104 facilitates improved accuracy in the location determination of the gaming device 102. Moreover, by performing the location determination locally at the gaming device 102, the location can be determined even without reliance on external computing systems. In

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certain embodiments, rather than determining a specific location of the gaming device 102, the gaming device 102 identifies a gaming table 104 associated with the gaming device 102 as described herein and assigns itself the predetermined location of the associated gaming table 104.

In response to determining its relative location, the gaming device 102 generates 412 location data 512 to be transmitted to the communication node 108. The location data 512 indicates the relative location and may also include other suitable data, such as a game data, maintenance scheduling data, and/or the like. The gaming device 102 may transmit 414 the location data 512 to the communication node 108 via one or more gaming tables 104 and the second communication network 112. The communication node 108 collects the location data 512 and transmits the data 512 to the server system 110 for storage and analysis. In some embodiments, the gaming tables 104 and/or the server system 110 may generate the distance data 510 and/or the location data 512 rather than the gaming device 102. In such embodiments, the gaming tables 104 and/or the server system 110 may collect the corresponding data to generate the distance data 510 and/or the location data 512. In one example, the gaming device 102 generates the distance data 510 and transmits the distance data 510 to the server system 110. The server system 110 then generates the location data 512 as a function of the predetermined locations of the gaming tables and the distance data 510.

The method 400 may be repeated for a plurality of gaming devices 102 such that the server system 110 may identify and monitor the location of every gaming device 102 deployed within the gaming environment 101. In at least some embodiments, gaming devices 102 that are not deployed within the gaming environment 101 may notify the server system 110 of its location. In one example, at least some gaming devices 102 may include power storage devices (e.g., batteries) and/or low-power modes to facilitate location determination while the gaming devices 102 are not deployed. In other embodiments, the absence of a location determination by a particular gaming device 102 may be inferred that the gaming device 102 is not deployed and inactive. These gaming devices 102 may be in storage, maintenance, at other gaming environments 101, and the like. Monitoring the location of the devices 102 may provide increased awareness of the how the gaming devices 102 are being used.

In at least some embodiments, the server system 110 is further configured to generate a dynamic map 514 of the gaming environment 101 that identifies the location of each gaming device 102 and each gaming table 104. The dynamic map 514 may be presentable to an operator for analysis. The location of the gaming devices 102 may be updated over time to monitor the current and historical movements of the gaming devices 102. The server system 110 may be configured to prompt the gaming devices 102 and/or the gaming tables 104 to generate the location data 512 periodically to update the dynamic map 514. In other embodiments, the gaming devices 102 and/or the gaming tables 104 may generate location data 512 in response to the gaming devices 102 moving relative to the gaming tables 104 and may transmit the location data 512 to the server system 110 via the communication node 108 to update the dynamic map 514. Alternatively, in embodiments in which the server system 110 generates the location data 512, the gaming devices 102 and/or the gaming tables 104 transmit updated distance data 510 to the server system 110 to update the dynamic map 514.

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The networked gaming device system 100 is not limited to locating gaming devices 102 within a gaming environment 101. For example, the system 100 may also be used to generate and transmit gaming data, game settings, device data, usage data, and other suitable data associated with the system 100. FIG. 6 is a data flow diagram of exemplary data transmitted within the system 100 (shown in FIG. 1). In other embodiments, other data may be transmitted and/or generated by the system 100, including data described elsewhere herein.

In the example embodiment, a gaming device 102 may be associated with a particular stationary gaming table 104. For example, a card-handling device may be deployed to a table for play of a card-based game, such as blackjack or poker. Associating the gaming device 102 with the gaming table 104 may facilitate certain and/or prevent certain functionalities of the gaming device 102 and the gaming table 104. For example, other than data signals transmitted for location determination (e.g., the data signal 502, shown in FIG. 5), the gaming device 102 or the gaming table 104 may block other data from being transmitted to and/or received from unassociated devices. The associated gaming device 102 and gaming table 104 may be configured to generate and communicate game data 602 associated with play of the game. In at least some embodiments, the gaming device 102 is associated with a gaming table 104 based at least partially on the relative distances between the gaming device 102 and one or more gaming tables 102. For example, if the relative distance to the gaming table 104 is within a threshold predetermined distance (e.g., one meter or half of a meter) and no other gaming table 104 has a similar relative distance, the gaming device 102 may be associated with the relatively close gaming table 104. The association may also be partially based on the type of gaming device 102 and what game is to be played at a particular gaming table 104. For example, the gaming device 102 and/or the gaming tables 104 may broadcast game type, device type, and the like to each other. Based on the broadcasted data, the gaming device 102 and/or the gaming tables 104 determine whether or not the gaming device 102 is compatible. If a gaming device 102 is determined to be incompatible (e.g., a card-handling device for a dice-oriented table game), the gaming device 102 may ignore the incompatible gaming table 104 irrespective of its relative distance.

The association may be determined by the gaming device 102, the gaming tables 104, and/or the server system 110. In some embodiments, the gaming tables 104 and/or the server system 110 may store game settings 604 to configure the gaming device 102 for the game. The game settings 604 may include, but are not limited to, rules of the game, number of cards shuffled, number of available card decks, card information, artwork, animations, wagering thresholds, and/or other configurable aspects of the gaming device 102. The game settings 604 may be transmitted to the gaming device 102 in response to associating with the gaming table 104. The gaming device 102 may automatically be configured in accordance with the game settings to reduce necessary time to manually prepare the gaming device 102.

According to some embodiments, the gaming device 102 may be manually prepared with the game settings 604, upon which the gaming table 104 and/or the server system 110 may store the game settings 604. If the gaming device 102 should be removed from the gaming table 104, for example, for repair or maintenance, a replacement gaming device 102 may then be automatically configured in accordance with the stored game settings of the gaming device previously at the gaming table 104 to reduce the preparation time for the

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replacement gaming device 102. For example, table controller 304 may store the game settings 604 in its associated memory 310 until needed, at which time, the table controller 304 may transmit the game settings 604 to the gaming device 102 via the table transceiver 306. As previously noted, a given gaming table 104 may have a number of processors with associated memories. In various embodiments, each of these may be capable of performing the operation of restoring game settings 604 in a replacement gaming device 102. In a non-limiting example, in embodiments where the gaming table 104 does not include a table controller 304 and the table transceiver 306 operates independently, the table transceiver 306 may restore game settings 604 to the replacement gaming device 102.

In response to associating the gaming device 102 to a gaming table 104, the gaming device 102 may transmit data to the gaming table 104 to be collected by the server system 110 via the communication node 108. The data may also include data generated by the gaming table 104. In some embodiments, the server system 110 is configured to periodically collect the data from the gaming tables 104 (i.e., via polling). In other embodiments, the gaming tables 104 transmit the data asynchronously to the communication node 108 for storage and analysis by the server system 110. At least some data may remain local to the associated gaming device 102 and gaming table 104 (i.e., the data is not transmitted to the communication node 108). The data may include, but is not limited to, the game data 602, device data 606, and location data 608 (e.g., the location data 512, shown in FIG. 5). The game data 602 includes data associated with the game played at the gaming table 104. Examples of game data 602 may include, but are not limited to, wager amounts, wagered outcomes, payouts, game outcomes, progressive jackpot amounts, number of players, bonus game outcomes, number of cards or decks remaining, image data associated with the game, number of shuffles, game play events, game sessions, use in a period, and/or other suitable data associated with the game.

The parameter of the number of shuffles can represent the number of full deck shuffles performed by the gaming device 102. When multiple decks are shuffled, the parameters can reflect the total number of decks shuffled. The parameter of the number of cards shuffled can represent the number of cards shuffled by the gaming device 102. In an embodiment when a particular card is shuffled multiple times over the course of a time period, the parameter is incremented each time the card is shuffled. In another embodiment, a card is shuffled once when the card is part of a shuffle process in which one or more decks of cards are completely shuffled.

The parameter of a game play event can represent the number of completed games/hands at a table 104. For example, one game play event for blackjack represents the dealing of cards between the placement of an initial bet and the final result of the hand. In one embodiment, if there are five players at a table, the completion of one hand for all players and the dealer represents five game plays, in some embodiments the dealer's hand is also counted so this represents six game plays, in another embodiment this represents one game play.

The parameter of a game session can represent a series of game plays/deals for a particular type of game played such as blackjack, THREE CARD POKER®, etc., without a significant break in play. For example, if a gaming device 102 is used for THREE CARD POKER® and is in continuous use, e.g., shuffling and dealing cards with no more than a five-minute break (other break period criteria can be used),

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for six hours, then the gaming device 102 is used for blackjack, then the six hours of THREE CARD POKER® is one game play session.

The parameter of use in a period can represent the total amount of usage of the gaming device 102 in a period. Examples of usage are number of shuffles, number of cards shuffled, number of game play events, and/or game sessions. The information can assist in identifying trends in the amount of game plays of particular games, e.g., THREE CARD POKER®.

The device data 606 includes operating conditions, diagnostics, maintenance reminders, and/or other data associated with the gaming device 102. At least some of the device data 606 is collected by sensors (e.g., the sensor system 204, shown in FIG. 2) monitoring the gaming device 102.

In at least some embodiments, the server system 110 collects the game data 602, the device data 606, and/or the distance data 608 to generate usage data 610 associated with each gaming device 102. In some embodiments, the data received by the server system 110 may be collectively referred to as "operational data." The usage data 610 indicates how long the gaming device 102 has been active and in use, under what conditions, and/or other similar factors. The usage data 610 may be used to proactively identify gaming devices due for maintenance prior to device failure and/or to accurately monitor the use of rental or leased gaming devices within the gaming environments 101. Moreover, because the server system 110 monitors multiple gaming environments 101, the usage data 610 of gaming devices 102 that are deployed in multiple gaming environments over time may be captured by the system 100. The server system 110 may be configured to generate and present reports including the operational data for one or more gaming devices 102 and/or other data associated with the system 100. In certain embodiments, each gaming device 102 may be configured to generate its respective usage data 610 and transmit the usage data 610 to the server system 110 for storage and analysis. In other embodiments, the usage data 610 is transmitted to the gaming table 104, which stores and analyzes the usage data 610 locally, for example, by the memory and processor(s) of a table controller 304.

For example, if the game being played at a gaming table 104 is THREE CARD POKER®, in which the dealer and each player receive three cards delivered in a three-card packet by the gaming device 102 (e.g., shuffler), a dealer at the gaming table 104 may operate the gaming device 102 to shuffle the cards and press a button to indicate a start of the dealing process. The gaming device 102 then delivers a first packet of three cards, which goes to the dealer. The gaming device then continues to deliver packets of three cards each, which the dealer distributes to each of the players participating in the round, for example, two players. When dealing to all of the players is complete, the dealer presses the button again to signal the end of dealing to the gaming device 102. One final packet, delivered in anticipation of being dealt to a third, non-existent, player, goes unused and the gaming device 102 dispenses all of the remaining shuffled cards. The number of packets dealt between the first button press and the second button press may be transmitted as game data 602 by the gaming device 102 to the gaming table 104 to be collected by the server system 110 via the communication node 108. The server system 110 can then analyze the data and determine that, of the four packets dispensed, one packet went to the dealer, one packet went to each of two players and a final packet was dispensed by the gaming device 102 but not used (since there was no third player present to receive the packet). Thus, for a gaming table 104 with a

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gaming device **102** configured to deal THREE CARD POKER®, the server system **110** is able to determine from packet count data that two players participated in that round of play. This participation data may then be stored with the participation data for other rounds of play at that gaming table **104** for further analysis, discussed below. While the example of THREE CARD POKER® has been used, it should be clear that the disclosed embodiment applies equally to any other game that employs packets of cards of predetermined sizes. Not-limiting examples include Ultimate Texas Hold'Em®, Mississippi Stud®, and Let it Ride®.

In another example, the game being played at a gaming table **104** may be blackjack. Unlike in THREE CARD POKER®, each blackjack player may receive a different number of cards during a round of play. Thus, a different approach must be used to determine player participation in a round when the game being played at gaming table **104** is blackjack. In this case, as each card is dealt, the gaming device **102** may transmit a timestamp corresponding to the dealing of the card as game data **602** to the gaming table **104** to be collected by the system server **110** via the communication node **108**. Periodically, the server system **110** may analyze all of the timestamps collected during multiple rounds of play to identify the rounds and their lengths and to estimate and store the number of wagering positions participating in each round.

For example, consider the following hypothetical set of timestamps for cards dealt in a game of blackjack:

Start of first round:
 21:08:02.10—First card to player #1
 21:08:02.30—First card to player #2
 21:08:02.48—First card to player #3
 21:08:02.59—First card to player #4
 21:08:03.18—First card dealer (hole card, face down)
 21:08:03.38—Second card to player #1
 21:08:03.56—Second card to player #2
 21:08:04.15—Second card to player #3
 21:08:04.35—Second card to player #4
 21:08:04.56—Second card to dealer (face up)
 Dealer peeks at the hole card and does not have blackjack
 21:10:06.21—Player #1 takes one card (hits and stands)
 21:10:09.12—Player #2 takes one card (hits)
 21:11:11.45—Player #2 takes a second card (busts)
 Player #3 stands and takes no additional cards.
 21:11:14.75—Player #4 takes a card and stands.
 21:11:17.25—Player #4 takes one card (hits and stands).
 21:11:19.40—Dealer turns over the hole card, takes one additional card and stands.

Start of next round:
 21:11:26.02—First card to player 1
 21:11:26.24—First card to player 2

In the first round of the above example, the timestamp data shows that ten cards were quickly dealt, generally within one second of each other. Additional cards were then dealt with longer pauses in between, followed by an even longer pause before multiple cards were drawn out again with less than one second between them.

Because each blackjack player and the dealer may take a number of additional cards (or none) during a round, the longer periods between timestamps of the intermediate cards are largely meaningless, except to show what they are not: cards dealt in a “burst” at the start of a round. Thus, the analysis algorithm can simply look for the rapid dealing of an even number of cards bracketed by two longer pauses. The first pause indicates the end of the previous round, wherein the dealer pays wins and removes cards from the

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table in preparation for the next round. The second pause occurs when the dealer examines the hole card in the new round) and then, if the dealer does not have blackjack, waits to deal a card to the first player wishing to take a hit. In this example, analysis may assume that the ten cards dealt in rapid fashion were the initial burst of a round, wherein each player and the dealer received two cards. Subtracting the two cards dealt to the dealer, it can be inferred that cards were dealt to four wagering spots at the gaming table **104** during this round. In other embodiments, the dealer may receive only a single card in the burst. In this scenario, the burst would have an odd number of cards. If the burst is an odd number, subtracting one card from the number of cards in the burst and dividing by two may be used to determine the number of positions in play.

The system server **110** can thus infer and store player participation data and game play data, for example, when each new round started, the average length of each round, and the number of wagers participating in each round. As with the THREE CARD POKER® data, this participation data may then be stored with the participation data for other rounds of play at that gaming table **104** for further analysis.

The example of blackjack and an opening burst of dealt cards is illustrative, it should be clear that the disclosed embodiment applies equally to any other game that includes a signature dealing pattern of cards identifiable by timestamps associated with each of the cards dealt during play of the card game to identify one or more rounds of play and wherein the number of cards in the signature dealing pattern of each round may be used to determine a number of players or active wagering spots within each of the rounds.

In accordance with some embodiments, the participation data may be combined with other data collected by the system server **110**. For example, to begin each round of play at a gaming table **104**, each player must make a standard wager, but may also place a separate progressive wager in order to try to win a large award for particular game outcomes. For example, in an optional progressive wager for blackjack, the progressive pay table considers a player's first two cards and the dealer's first two cards. Progressive payable payouts start when the dealer's up-card is an ace and continue with larger payouts when the dealer has a blackjack. Top payouts are awarded for a premium four-card poker hand between the four cards. The progressive wagers are typically placed on a progressive “coin sensor” at each player's respective betting position at gaming table **104**. These wagers are detected and transmitted to a progressive system, such as a GM Atlas System manufactured by LNW Gaming, Inc., to increment the value of one or more progressive pools associated with the particular game being played at table **104**. The progressive coin sensor data from the progressive system may also be stored on a per hand basis in the system server **110**. While the coin sensor data reflects a raw count of the number of progressive wagers placed at each gaming table **104**, more useful information may be obtained when this data is combined with the above-described player participation data. For example, a percentage of players participating in the progressive game in each round at each gaming table **104** may be obtained by dividing the coin spot data for a particular round by the table headcount for that round (i.e., progressive participation percentage=coin spot data/table headcount data times **100**). Average overall progressive participation for each of a variety of progressive games being offered may then be derived from this information. Business decisions based on the relative popularity and profitability of each progressive game are then possible.

FIG. 7 is a flow diagram of an example method 700 of collection participation data at a blackjack table with a gaming device 102 within the gaming environment 101 using the networked gaming device system 100.

At step 702, data related to the time each card is dealt at the blackjack table is captured by the gaming device 102. At step 704, the gaming device 102 transmits the timestamp data to the gaming table 104, which forwards it to the communication node 108 at step 706. The timestamp data is then collected from the communication node 108 by the server system 110 at step 708.

At step 710, the system server 110 analyzes the timestamp data to detect the start of round dealing pattern described above. Typically, this pattern will be an even number of timestamps within a second of one another that occur after the dealing of a card several seconds prior, the previous card being the last card dealt prior to the dealer reconciling any remaining bets in the previous round, removing cards from the table, etc. This pattern is followed by another delay between dealt cards of more than a second, which is caused by the dealer examining the hole card and the first player, if any, to take a hit card.

At step 712, once the start of a round has been identified, the system server 110 assigns a number of seats dealt to in the round based on the number of cards in the “burst.” The dealer’s cards are subtracted. As described above, for example, if ten cards are dealt in the initial burst, $(10-2)/2=4$ cards were dealt to four betting spots. This may or may not be the number of players, as some players may play multiple hands. The system server 110 stores player participation data and game play data, for example, when each new round started, the average length of each round, and the number of wagers participating in each round.

At step 714, the collection and analysis of game participation data may be further analyzed and compiled into reports used to make business decisions related to the operation of the gaming tables 104, for example, how many gaming tables 104 to have in operation during particular hours or at various levels of participation, what mix of game types (blackjack, baccarat, THREE CARD POKER®, etc.) to deploy at those tables, what table wager limits to deploy at each table, the hours during which to raise or lower table wager limits, etc. In accordance with some embodiments, the system 100 may make real-time recommendations with respect to these decisions. In still other embodiments, the system 100 may automatically communicate changes to the gaming tables 104, for example, the system may transmit commands to the table controller 304 at a particular gaming table 104 to modify minimum and maximum wager values (i.e., table wager limits) indicated on an electronic display connected to the table controller 304 or to indicate whether the gaming table 104 is open or closed on such a display. In accordance with other embodiments, participation data is processed locally at the gaming table 104, for example, the timestamp data is stored and analyzed in the memory of the table controller

In at least some embodiments, the system 100 may be used to facilitate leasing gaming devices 102 to operators of the gaming environments 101. In particular, the system 100 may facilitate billing based on actual usage of the gaming devices 102. In some embodiments, the system 100 permits the reporting period, and any associated billing period, to be of any duration and based on any type of, or combination of, use. In other embodiments, billing amounts may include maintenance charges, fees, or other payable service events. Types of use for a card-handling gaming device include, but are not limited to, cards or decks inserted into the card

device, cards dispensed, cards counted, cards sorted, cards or decks checked for completeness, individual hands dealt, type of game played, individual games played, game sessions played, directly or indirectly based on any amount of winnings detected during play including any progressive, individual hand reports and game reports generated, and/or request for a report from a past card usage, past game or past session data including individual hands previously generated (past data may help a casino with a patron dispute, may help with a billing dispute, etc.). This may be downloaded to a card-handling device from a central location (e.g., the server system 110) where extended game data associated with each card-handling device may be stored, or, otherwise provided to a user (casino, operator) of the local card-handling device, if the device is unable to communicate or display the results of the request. Such data, billable events, and recallable events are based on the capabilities of each card-handling device. The level to which each card-handling device may record data in any form is reflected in the data kept at a central location for later recall, analysis, and use. Unsophisticated card-handling devices with limited reporting capabilities will have equally limited data available from any back-end system, while sophisticated card-handling devices will enable a back-end system to keep far more detailed records, respond to download requests for specific data and similar actions. The type of data available from a sophisticated card-handling device is limited only by its detectors and associated computer power. Any type of data related to card usage, deck usage or deck type (including, but not limited to, the deck’s manufacturer and other data), deck or card count of any kind, ordering in a randomized deck or partial deck, data for each dealt or issued card for any event (including card counting or deck determinations, as well as game play events), and any other type of count or event based on cards in any manner used in a card-handling device is contemplated herein.

The collected data may be organized, analyzed, and reported in any manner useful for either billing, meaning creating bills for payment eventually sent to the user of the device, or, maintenance of any type, including actual and predictive failure analysis and/or predictive required maintenance reports. Predictive reporting may be based in part, or in whole, on statistical analysis of the use data, error logs, interrupt events, fault reports, and any and all data, if available, from detectors or detection circuits, detection ICs, or any type of element that is configured to log or generate data regarding the condition of any element, either itself or another element. In at least some embodiments, the server system 110 and/or the gaming devices 102 may generate one or more alerts or notifications to notify a user of particular events based on analysis of the operational data.

Examples of detector elements includes elements such as strain detectors or motion detectors located on, or associated with, mechanical components, and failure detection ICs measuring various electrical/electronic properties of components so that anomalous events can be reported or logged. Similarly, detection elements may be failure detection (or condition monitoring) circuits contained in larger circuits reporting/logging performance deviations or apparent out-of-spec behaviors, and/or any other detection elements that generate logs, interrupts, or other events. This further includes firmware or software that may use algorithms coupled with input from one or more components or elements of any type (mechanical elements using or interfacing to mechanical-electrical, mechanical-optical, or other elements, all electronic elements, etc.) to generate data or report on actual, possible, or predictive failure events. This is by

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way of example only, the concept covers collecting and/or using or evaluating any data from failure detection elements, as implemented in various models of card-handling devices now or in the future.

In some embodiments, the server system 110 may be configured to at least partially control the operation of the gaming devices 102 by transmitting control data 612 to the gaming devices 102 via the gaming tables 104. The control data 612 may automatically cause the gaming device 102 to reconfigure and/or to perform one or more tasks. For example, if a gaming device 102 is identified as potentially malfunctioning based on the data received by the server system 110, the server system 110 may transmit control data 612 to cause the gaming device 102 to shut down and/or perform a diagnostic operation to identify a cause of the malfunction. In some embodiments, the gaming device 102 is configured to apply the control data 612 in response to associating with the gaming table 104. Otherwise, the gaming device 102 may ignore the control data 612. In other embodiments, the gaming device 102 may apply at least some control data 612 (e.g., diagnostics functions, shut down functions etc.) irrespective of the gaming device 102 associating with the gaming table 104.

In certain embodiments, the system 100 may further include user transceivers 118 for tracking the location of users within the gaming environments 101, such as employees and/or players. Each user transceiver 118 may be substantially similar to the device transceivers 206 shown in FIG. 2, though, in some embodiments, the user transceiver 118 may be different from the device transceivers. For example, the device transceiver 206 may be integrated with the device controller 202 (shown in FIG. 2), whereas the user transceiver may be a standalone apparatus. The user transceiver 118 is affixed to, coupled to, or held by a user 119 or the garments of the user 119.

The user transceiver 118 is configured to be incorporated within the method 400 (shown in FIG. 4) to determine the location of the user 119 similar to the determining the location of the gaming devices 102. For example, the user transceiver 118 communicates with the gaming tables 104 via the first communication network 106 to determine a relative distance between the user 119 and each gaming table 104. Based on the determined relative distances, the user transceiver generates location data indicating a relative location of the user. The location data is then transmitted to the server system 110 for storage with location data of other users and analysis. In certain embodiments, if the user 119 is an employee of the gaming environment, the user transceiver 118 may be configured to identify a role or position of the user 119. For example, if the user 119 is a card dealer, the user transceiver 118 may transmit identification data indicating the user 119 is a card dealer to the gaming tables 104. In some embodiments, the user transceiver 118 may be configured to collect and generate other suitable data, such as performance data, time spent at a particular gaming table 104, and the like.

Embodiments will vary as to what and where data collection, reporting, and analysis are done. In some embodiments, a gaming device may be fairly simple and relatively inexpensive, and its data collection and reporting capabilities will reflect these limitations. In one embodiment, such a gaming device will do no data analysis at all; it will all be done at a server location (or other computer that eventually receives or has access to the data). At the other end of the spectrum may be multi-functional gaming devices having the ability to perform multiple game functions as well as support multiple games, and further having their own dis-

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plays, printers, and other components. Such sophisticated gaming devices may do some analysis of the data collected that enables them to generate, locally in a manner readable by humans. This may include output to a printer or on a screen. This enables a casino or other user of the device to track their usage, current amount owed, possible servicing requirements, and other parameters.

It is expected that the most sophisticated data analysis regarding predictive failure analysis will be done centrally, at least in part because more sophisticated analysis uses data from many gaming devices. However, some or all of the results of such analysis may be downloaded to any individual gaming devices that are sophisticated enough to use them, typically in the form of what the gaming device may detect in terms of patterns in its own data. Examples of such patterns may include the occurrence of certain logged events during a specified time period from a component, or certain data entries, measurements, interrupts, or logs from a set of components that by themselves do not raise an alarm, but do raise an alarm when they occur together, etc. Any and all patterns determined by data analysis are conceptually included herein.

Reference in the specification to “one embodiment” or to “an embodiment” means that a particular feature, structure, or characteristic described in connection with the embodiments is included in at least one embodiment. The appearances of the phrase “in one embodiment” or “an embodiment” in various places in the specification are not necessarily all referring to the same embodiment.

Some portions of the detailed description are presented in terms of algorithms and symbolic representations of operations on data bits within a computer memory. These algorithmic descriptions and representations are the means used by those skilled in the data processing arts to most effectively convey the substance of their work to others skilled in the art. An algorithm is here, and generally, conceived to be a self-consistent sequence of steps (instructions) leading to a desired result. The steps are those requiring physical manipulations of physical quantities. Usually, though not necessarily, these quantities take the form of electrical, magnetic, or optical signals capable of being stored, transferred, combined, compared, and otherwise manipulated. It is convenient at times, principally for reasons of common usage, to refer to these signals as bits, values, elements, symbols, characters, terms, numbers, or the like. Furthermore, it is also convenient at times, to refer to certain arrangements of steps requiring physical manipulations or transformation of physical quantities or representations of physical quantities as modules or code devices, without loss of generality.

However, all of these and similar terms are to be associated with the appropriate physical quantities and are merely convenient labels applied to these quantities. Unless specifically stated otherwise as apparent from the following discussion, it is appreciated that throughout the description, discussions utilizing terms such as “processing,” “computing,” “calculating,” “determining,” “displaying,” or “determining,” or the like, refer to the action and processes of a computer system, or similar electronic computing device (such as a specific computing machine), that manipulates and transforms data represented as physical (electronic) quantities within the computer system memories or registers or other such information storage, transmission or display devices.

Certain aspects of the embodiments include process steps and instructions described herein in the form of an algorithm. It should be noted that the process steps and instruc-

tions of the embodiments can be embodied in software, firmware, or hardware, and when embodied in software, could be downloaded to reside on and be operated from different platforms used by a variety of operating systems. The embodiments can also be in a computer program product, which can be executed on a computing system.

The embodiments also relate to an apparatus for performing the operations herein. This apparatus may be specially constructed for the purposes, e.g., a specific computer, or it may comprise a general-purpose computer selectively activated or reconfigured by a computer program stored in the computer. Such a computer program may be stored in a computer-readable storage medium, such as, but not limited to, any type of disk including floppy disks, optical disks, CD-ROMs, magnetic-optical disks, read-only memories (ROMs), random access memories (RAMs), EPROMs, EEPROMs, magnetic or optical cards, application specific integrated circuits (ASICs), or any type of media suitable for storing electronic instructions, and each coupled to a computer system bus. Memory can include any of the above and/or other devices that can store information/data/programs and can be transient or non-transient medium, where a non-transient or non-transitory medium can include memory/storage that stores information for more than a minimal duration. Furthermore, the computers referred to in the specification may include a single processor or may be architectures employing multiple processor designs for increased computing capability.

The algorithms and displays presented herein are not inherently related to any particular computer or other apparatus. Various general-purpose systems may also be used with programs in accordance with the teachings herein, or it may prove convenient to construct more specialized apparatus to perform the method steps. The structure for a variety of these systems will appear from the description herein. In addition, the embodiments are not described with reference to any particular programming language. It will be appreciated that a variety of programming languages may be used to implement the teachings of the embodiments as described herein, and any references herein to specific languages are provided for disclosure of enablement and best mode.

While particular embodiments and applications have been illustrated and described herein, it is to be understood that the embodiments are not limited to the precise construction and components disclosed herein and that various modifications, changes, and variations may be made in the arrangement, operation, and details of the methods and apparatuses of the embodiments without departing from the spirit and scope of the embodiments as defined in the appended claims.

What is claimed is:

1. A system for monitoring player participation at moveable table game devices used in connection with stationary gaming tables in a gaming environment, the system comprising:

- a plurality of stationary gaming tables positioned at a plurality of respective locations, each gaming table equipped with a table transceiver and associated memory, each table transceiver in communication with a first communication network and a second communication network different from the first communication network;
- a moveable table game device equipped with a device transceiver and associated memory, the device transceiver configured to transmit and receive data signals including operational data via the first communication network with table transceivers of the plurality of stationary gaming tables;

one or more processors, individually or in combination, being configured to generate operational data associated with the moveable table game device at least partially as a function of data associated with cards distributed by the moveable table game device during play of a card game;

a communication node in communication with the second communication network, the communication node configured to collect the generated operational data from at least one of the table transceivers over the second communication network; and

a server with associated memory, the server communicatively coupled to the communication node and configured to receive, store and analyze the collected operational data.

2. The system of claim 1, wherein the first communication network is an ultra-wideband network.

3. The system of claim 1, wherein the operational data comprises a number of packets of cards distributed by the moveable table game device between an occurrence of a first event and an occurrence of a second event.

4. The system of claim 3, wherein the card game is at least one of THREE CARD POKER®, Ultimate Texas Holdem®, Mississippi Stud®, or Let It Ride®.

5. The system of claim 1, wherein the operational data comprises timestamps associated with each card distributed by the moveable table game device.

6. The system of claim 5, wherein the server analyzes the timestamps to identify a timestamp-based signature pattern of cards dealt during a round of play of the card game.

7. The system of claim 6, wherein the server determines a player participation level based on the number of cards dealt in the signature pattern of cards.

8. The system of claim 7, wherein the card game is blackjack.

9. A method of determining player participation at one of a plurality of stationary gaming tables, the method comprising:

distributing cards during a plurality of rounds of a card game played at the one of the plurality of stationary gaming tables via a moveable table game device equipped with one or more processors, a device transceiver and associated memories, the device transceiver configured to communicate data signals via a first communication network to and from a table transceiver and associated memory of the one of the plurality of stationary gaming tables, the table transceiver in communication with the first communication network and a second communication network different from the first communication network;

generating, via the one or more processors, individually or in combination, timestamp data associated with the cards distributed by the moveable table game device; transmitting, via the device transceiver and the table transceiver, the timestamp data to the stationary gaming table;

transmitting, via the table transceiver, the timestamp data to a communication node in communication with the second communication network, the communication node configured to collect the generated timestamp data from the table transceiver over the second communication network;

receiving the timestamp data at a server with associated memory, the server communicatively coupled to the communication node and configured to receive, store, and analyze the collected timestamp data;

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analyzing the timestamp data to identify a plurality of rounds of play of the card game according to a timestamp-based signature dealing pattern in each round; and

based on the number of cards dealt in the signature dealing pattern in each round, determining and assigning a player participation level to each of the identified rounds.

10. The method of claim 9, wherein the card game is blackjack.

11. The method of claim 10, wherein the signature dealing pattern in each round comprises an initial burst of dealt cards.

12. The method of claim 9, wherein the number of cards in the signature dealing pattern is odd and wherein the participation level in each round is determined at least in part by dividing the number of cards in the signature dealing pattern by two.

13. The method of claim 12, wherein the number of cards in the signature dealing pattern is reduced by one prior to determination of each participation level to account for a card dealt to the dealer.

14. The method of claim 9, wherein the signature dealing pattern is identified by a block of contiguous timestamps of cards separated by an interval less than one second.

15. The method of claim 9, further comprising generating a recommendation for action based on analysis of the participation level assigned to one or more of the identified rounds of play.

16. The method of claim 15, wherein the analysis of the participation level assigned to the one or more identified rounds of play comprises progressive game data.

17. The method of claim 15, wherein the recommendation for action comprises adjusting wagering limits at the one of the plurality of gaming tables.

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18. A method of determining player participation at one of a plurality of stationary gaming tables, the method comprising:

distributing cards during a plurality of rounds of a card game played at the one of the plurality of stationary gaming tables via a moveable table game device equipped with one or more processors, a device transceiver and associated memories, the device transceiver configured to communicate data signals via a first communication network to and from a table transceiver and associated memory of the one of the plurality of stationary gaming tables;

generating, via the one or more processors, individually or in combination, timestamp data associated with the cards distributed by the moveable table game device; transmitting, via the device transceiver and the table transceiver, the timestamp data to a table controller of the stationary gaming table;

analyzing the timestamp data, via the table controller, to identify a plurality of rounds of play of the card game according to a timestamp-based signature dealing pattern in each round; and

based on the number of cards dealt in the signature dealing pattern in each round, determining, and assigning a player participation level to each of the identified rounds.

19. The method of claim 18, wherein the signature dealing pattern in each round comprises an initial burst of dealt cards.

20. The method of claim 18, wherein the number of cards in the signature dealing pattern is odd and wherein the participation level in each round is determined at least in part by dividing the number of cards in the signature dealing pattern by two.

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