A

TITLE OF THE INVENTION

System and Process for Transmitting Image Data to a Bicycle Wheel LED Display

- Small validation ¶, but at least it is there
- You took a shot at "push" & "Route maximization"
  ↳ It's not enabled, but you disclosed everything you were given
- Your specification is very thorough overall! Good Job!

BACKGROUND OF THE INVENTION

[0001] The invention generally relates to a system and method for transmitting image data to a bicycle wheel light emitting diode (LED) display. More particularly, the invention relates to a system and method for transmitting image data from a server to a bicycle wheel LED display based on the location of the bicycle wheel LED display.

too much
this is POV

[0002] Bicycle wheel LED displays take bicycle lights to a new level by incorporating LED lights to display images or animations. Because of a phenomenon known as persistence of vision, when multiple LED lights are illuminated on bicycle wheel spokes, the multiple LED lights blend into a single image. With these bicycle wheel LED displays, cyclists can customize their bicycle in addition to improving visibility of the bicycle on the road.

[0003] In some existing bicycle wheel LED displays, images or animations come pre-loaded on the display. Additionally, in some existing bicycle wheel LED displays, images and animations can be transmitted to the bicycle wheel LED display through a Bluetooth connection with a mobile communication device.

[0004] A bicycle wheel electronic display apparatus is disclosed in Goldwater, U.S. Pub. No. 2012/0200401. Goldwater discloses an electronic light display apparatus that is mounted on a bicycle wheel. The electronic light display includes an array of LED lights and a microprocessor. The microprocessor includes memory which stores display pattern data and modulates the LED lights according to the display pattern data stored in the memory.

[0005] A wheeled vehicle with pattern lighting is disclosed in Dua, U.S. Pub. No. 2015/0217598. Dua discloses a wheeled vehicle that includes lighting elements on a disc affixed to the vehicle wheel. The disc is mounted to the same axle as the vehicle wheel but rotates separately from the wheel. Each of the lighting elements on the disc are lit as the disc rotates based on the rotational position of the disc. Lighting elements can be arranged to produce the illusion of a pattern or picture. Dua further discloses a processor to control the lighting elements. The processor disclosed is preprogramed with a particular patterns or pictures. Additionally, the processor is programable through a wireless connection, such as a Bluetooth connection.

[0006] A system for tracking the motion of a bicycle is disclosed in Klosinski, U.S. Pub. No. 2016/0223577. The Klosinski system includes a bicycle, magnets disposed on the bicycle, and magnetometers embedded in a computing device. The Klosinski system is configured to determine the location of a bicycle based on magnetic field information associated with magnets disposed on the bicycle as determined by the magnetometers. The Klosinski system used to determine metrics related to the movement of the bicycle, including speed or distance traveled.

good ~~job~~ job sticking closely to the references!

BRIEF SUMMARY OF THE INVENTION

[0007] One or more of the embodiments of the invention provide a system and a method for transmitting image data from a server to a bicycle wheel LED display based on the location of the bicycle wheel LED display, wherein the location data is received from a smartphone located proximate to the bicycle wheel LED display. The system includes a computer, wherein the computer includes a user interface, a server, a smartphone, wherein the smartphone includes a GPS and a wireless transceiver, and an LED display, wherein the LED display includes an LED light bank and a wireless transceiver, wherein the LED display is affixed to a bicycle wheel. The server is connected to the computer and the smartphone through a communication link. Furthermore, the smartphone is located proximate to the LED display and is connected to the LED display through a wireless communication link.

[0008] The server receives image data, central location data, and radius data through a computer user interface. Upon receiving the image data, the central location data, and the radius data, the computer transmits image data to a server. The server saves image data, the central location data, and the radius data in the server memory in a user account database. Together, the central location data and radius data define the perimeter of a geographic area (as described in Figure 13). The server also receives LED display location data from a smartphone located proximate to the LED display. Upon receiving the LED display location data, the server stores the LED display location data in the server memory in an LED display database. Next, the server data processor calculates the distance between the central location data and the LED display location data. Upon calculating the distance between the central location data and the LED display location data, the server data processor compares the distance between the distance between the central location data and the LED display location data to the radius data. If the distance between the central location data and the LED display location data is greater than the radius data, the server transmits the image data to the smartphone through the communication link. The smartphone then transmits the image data to the LED display through the wireless communication link. Upon receiving the image data, the LED light bank on the LED display is activated in response to the image data.

[0009] In another embodiment, the server also determines the image data to transmit to an LED display based on a price data representing a price that a user pays to transmit image data to the LED display. In addition to determining an image to display based on central location data and radius data, the server data processor determines the image data based on price data associated with the image data in the user account database. The server transmits the image data associated with the highest price data to the bicycle LED display.

It ~~is~~ not wrong to make it this long, but you can stop after the 1st paragraph

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] Figure 1A illustrates a bicycle wheel display system according to an embodiment of the present invention.

[0011] Figure 1B illustrates the server memory of the bicycle wheel display system according to an embodiment of the present invention.

[0012] Figure 1C illustrates the LED display memory of the bicycle wheel display system according to an embodiment of the present invention.

[0013] Figure 2 illustrates a webpage which is an embodiment of the computer user interface.

[0014] Figure 3 illustrates a flowchart of a process for creating an account by transferring input data associated with the account to the server.

[0015] Figure 4 illustrates a user interface of a smartphone according to an embodiment of the present invention.

[0016] Figure 5 illustrates a Setup user interface for a smartphone according to an embodiment of the present invention.

[0017] Figure 6 illustrates a flowchart of a process for creating an account for an LED display by transferring input data to a server.

[0018] Figure 7 illustrates a flowchart of a process for receiving and storing data representing the location of an LED display at the server.

[0019] Figure 8A and Figure 8B illustrate a flowchart of a process for selecting image data to transmit to an LED display and transmitting the image data to the LED display.

[0020] Figure 9 illustrates a flowchart of a process for calculating payment for transmitting image data to an LED display.

[0021] Figure 10 illustrates an auction process for selecting image data to transmit to an LED display when multiple user accounts IDs are selected.

[0022] Figure 11 illustrates an LED display trip user interface for the smartphone according to an embodiment of the present invention.

[0023] Figure 12 illustrates an Error user interface for the smartphone according to an embodiment of the present invention.

[0024] Figure 13 illustrates a geographic area as defined by the central location data and the radius data in the user account.

DETAILED DESCRIPTION OF THE INVENTION

[0025] Figure 1A illustrates a bicycle wheel display system 100 according to an embodiment of the present invention. The bicycle wheel display system 100 includes a server 110, a smartphone 120, a computer 130, and a light emitting diode (LED) display 140. The server 110 includes a server memory 112, a data processor 114, a server transceiver 116, and a clock 118. The smartphone 120 includes a smartphone transceiver 122, a global positioning system (GPS) 124, a smartphone wireless transceiver 126, and a smartphone user interface 128. The computer 130 includes a computer transceiver 132 and a computer user interface 134. The LED display 140 includes an LED display wireless transceiver 142, an LED light bank 144, an LED display memory 146, and a battery 148.

[0026] In the bicycle wheel display system 100, the server 110 is in communication with the computer 130. The server 110 is electronically connected to the server memory 112, the data processor 114, and the server transceiver 116. The server 110 communicates with the computer 130 through a network connection 150. The computer transceiver 132 on the computer 130 transmits data from the computer user interface 134 to the server transceiver 116 on the server 110 through the network connection 150 (as further discussed in Figure 3). The computer user interface 134 is part of the computer 130. The computer transceiver 132 is electronically connected to the computer 130.

[0027] Additionally, the server 110 is in communication with the smartphone 120. The server 110 is electronically connected to the server memory 112, the data processor 114, and the server transceiver 116. The server 110 communicates with the smartphone 120 through a network connection 152. The smartphone 120 is electronically connected to the smartphone transceiver 122, the GPS 124, the smartphone wireless transceiver 126, and the smartphone user interface 128. The server transceiver 116 transmits data to and receives data from the smartphone transceiver 122 through the network connection 152 (as detailed in Figures 7, 8A, and 8B). In operation, the smartphone 120 communicates with the LED display 140 through a wireless communication link 154. The smartphone wireless transceiver 126 transmits data from the smartphone 120 to the LED display wireless transceiver 142 through the wireless communication link 154. The LED display is electronically connected to the LED display wireless transceiver 142, the LED light bank 144, the LED display memory 146, and the battery 148.

[0028] In operation, the bicycle wheel display system 100 involves four main components: the server 110, the computer 130, the smartphone 120, and the LED display 140. The computer 130 receives input data through the computer user interface 134 (further discussed in Figure 2). The input data received through the computer user interface 134 includes image data associated with a user account. Next, the computer transceiver 132 transmits the input data from the computer 130 to the server 110 through the network connection 150. At the server 110, the input data is received by the server transceiver 116 and is stored in the server memory 112.

[0029] Additionally, in operation, the smartphone 120 determines current LED display location data using the smartphone GPS 124 (further discussed in Figure 7 and 8A). The smartphone 120 also receives input data through the smartphone user interface 128 (further discussed in Figure 6). The smartphone transceiver 122 transmits the current LED display location data and the input data from the smartphone 120 to the server 110 through the network connection 152. The data processor 114 queries the server memory 112 for image data to transmit to the LED display 140. The query of the server memory 112 utilizes the central location data, the radius data, the start time data, the stop time data, the color data, and the animation data in the user account database and the LED display color data, the LED display animation data, the LED display location data, and the current time data in the LED display database (further discussed in Figures 8A and 8B). After the image data has been selected through a query of the server memory 112, the server transceiver 116 of the server 110 transmits the image data to the smartphone transceiver 122 of the smartphone 120. Next the image data is transmitted from the Smartphone wireless transceiver 126 the LED display wireless transceiver 142. The image data is then transferred to the LED light bank 144 on the LED display 140.

[0030] In one embodiment, the LED display 140 is affixed to the spokes of a bicycle.

[0031] In one embodiment, the smartphone wireless transceiver 126 and the LED display wireless transceiver 142 are Bluetooth communication devices.

[0032] In an alternative embodiment, the smartphone 120 may be a tablet computer, a smartwatch, any other wearable computer devices, or any other portable computing device.

[0033] In an alternative embodiment, the LED light bank 144 may contain 256 LED lights or 376 LED lights. monochrome LED lights, 16+ color LED lights, 256+ color LED lights, or 4000+ color LED lights.

[0034] In an alternative embodiment, the network connection 150, the internet connection may be a wireless internet connection or a wired internet connection, such as a local area network (LAN), a cable-broadband internet connection, a DSL connection, a dial-up access connection, or a satellite connection.

[0035] Figure 1B illustrates the server memory 112 of the bicycle wheel display system 100 according to an embodiment of the present invention. The server memory 112 includes a user account database 150. The user account database 150 contains data that is associated with an account created by a user. The user account database 150 includes the following data: a max ad price data 151, a total ad budget data 152, a radius data 153, a central location data 154, a start time data 155, a stop time data 156, an animation data 157, a color data 158, an image data 159, a payment data 160, a user account ID data 161, a user account name data 162. The max ad price data 151 represents the maximum amount of money that a user will pay to transmit image data to an LED display. The total ad budget data 152 represents the total amount of money that a user has available for paying to transmit image data to an LED display. Together, the central location data 154 and radius data 153 define a geographic area. The central location of the geographic area is defined by the central location data 154 and the perimeter of the geographic area is defined by the radius data 153. The start time data 155 represents the time that image data 159 will start being transmitted from the server to the LED display. The stop time data 156 represents the time that image data 159 will stop being transmitted from the server to the LED display. The animation data 157 is indicative of the animation capability of the LED display that is selected to receive the image data 159. The color data 158 is indicative of the color capability of the LED display that is selected to receive the image data 159. The payment data 160 represents bank account information that is used to pay for transferring image data to an LED display. The user account ID data 161 represents a unique identification number associated with a user account. The user account name data 162 is text data that represents a name associated with the user account.

[0036] The server memory 112 also includes an LED display database 170. The LED display database contains data associated with an account for an LED display (as shown in Figure 1A), wherein the LED display receives image data from the server. The LED display database 170 includes the following data: an LED display color data 171, an LED display model data 172, an LED display animation data 173, an LED display name 174, a payment data 175, an LED display ID data 176, and a minimum speed data 177. The LED display color data 171 represents the color capability of an LED display. The LED display model data 172 represents the model of an LED display. The LED display animation data 173 represents the animation capability of an LED display. The LED display name data 174 is text data that represents a name associated with the LED display account. The payment data 175 represents bank account information that is used to receive payment for receiving image data at the LED display. The LED display ID data 176 represents a unique identification number associated with an LED display account. The minimum speed data 177 represents the minimum speed for the LED display model as specified by the LED display model manufacturer.

[0037] The server memory 112 further includes an LED display trip database 180. The LED display trip database 180 includes the following data: an LED display trip ID data 181, an LED display location data 182, a current time data 183, a trip duration data 184, a trip distance data 185, a total amount earned data 186, a total ad count data 187, an LED display speed data 188, a trip start time data 189, and a trip stop time data 190. The LED display trip ID data 181 represents a unique identification number associated with an

LED display trip. The LED display location data 182 represents the location of the LED display during the LED display trip. The current time data 183 represents the time that the LED display location data 182 is received at the server. The trip duration data 183 represents the amount of time that the LED display is available to receive image data 159 from the server. The trip distance data 185 represents the total distance traveled by the LED display during the LED display trip. The total amount earned data 186 represents the total payment amount received for receiving image data at the LED display. The total ad count data 187 represents the total number of times that an image data 159 is transmitted from the server to the LED display. The LED display speed data 188 represents the speed of the LED display during the LED display trip. The trip start time data 189 represents the time that the LED display becomes available for receiving image data from the server. The trip stop time data 190 represents the time that the LED display was no longer available for receiving image data from the server.

[0038] In operation, the user account database 150 is stored on the server. Additionally, in operation the max ad price data 151, the total ad budget data 152, the radius data 153, the central location data 154, the start time data 155, the stop time data 156, the animation data 157, the color data 158, the image data 159, the payment data 160, and the user account name data 162 are associated with the user account ID data 161 such that all of the data associated with a user account in the user account database is identifiable based on the user account ID 161.

[0039] In operation, the LED display database 170 is stored on the server. Additionally, in operation the LED display color data 171, the LED display model data 172, the LED display animation data 173, the LED display name 174, the payment data

175, and the minimum speed data 177 are associated with the LED display ID data 176 such that all of the data associated with the LED display account in the LED display database is identifiable based on the LED display ID data 176.

[0040] In operation, the LED display trip database 180 is stored on the server. Additionally, in operation the LED display location data 182, the current time data 183, the trip duration data 184, the trip distance data 185, the total amount earned data 186, the total ad count data 187, the LED display speed data 188, a trip start time data 189, and a trip stop time data 190 are associated with the LED display trip ID data 181 such that all of the data associate with the LED display trip in the LED display trip database is identifiable based on the LED display trip ID data 181.

[0041] In one embodiment, the image data 159 is a video file, such as a .avi or .mov, or a picture file, such as a .jpg or a .png.

[0042] In one embodiment, the payment data 160 and the payment data 175 is Paypal account information. In another embodiment, the payment data 160 and the payment data 175 include a bank account number and a bank routing number.

[0043] In one embodiment, the color data includes 158 data that indicates a color capability of monochrome, 16+ colors, 256 colors, or 256+ colors.

[0044] In another embodiment, the animation data includes data that indicates that an LED display is capable of displaying animation or that an LED display is not capable of displaying animation.

[0045] Figure 1C illustrates the LED display memory 146 of the bicycle wheel display system 100 according to an embodiment of the present invention. The LED display memory 146 includes a power level data 192, an LED display color data 194, a minimum speed data 195, an LED display model data 196, and an LED display animation data 198. The power level data 192 represents the remaining battery power level of the LED display. The LED display color data 194 represents the color capability of an LED display. The minimum speed data 195 represents the minimum speed for the LED display model as specified by the LED display model manufacturer. The LED display model data 196 represents the model of an LED display. The LED display animation data 198 represents the animation capability of an LED display.

[0046] In operation, the power level data 192, the LED display color data 194, the minimum speed data 195, the LED display model data 196, and the LED display animation data 198 is stored on the LED display memory 146.

[0047] In one embodiment, the LED display color data 194 includes data that indicates a color capability of monochrome, 16+ colors, 256 colors, or 256+ colors.

[0048] In another embodiment, the LED display animation data includes data that indicates that an LED display is capable of displaying animation or that an LED display is not capable of displaying animation.

[0049] Figure 2 illustrates a webpage 200 which is an embodiment of the computer user interface 134 of the computer 130 (further detailed in Figure 1A). Each input field 210–290 on the webpage 200 represents input data that will be stored in user account database at the server 110. The input fields include an account name field 205, a max ad price input field 210, a total ad budget input field 220, a display radius input field 230, a GPS location input field 240, a time input field 250, an animation input field 260, a color input field 270, an image file input field 280, and a map 290.

[0050] As described with respect to system 100 in Figure 1, input data received through the webpage 200 is transmitted to the server 110 and stored in the server memory 112. The input data that is received from the webpage 200 is stored in the server memory 112 as a user account.

[0051] In one embodiment, the source of input data for the user interface 200 is from an internet user inputting data into a webpage.

[0052] In another embodiment, the image data 280 may be a video file, such as a .avi or .mov, or a picture file, such as a .jpg or a .png.

[0053] In another embodiment, the map 290 is interactive and allows a user to select a location on the map 290 to determine the GPS coordinates of the location.

[0054] Figure 3 illustrates a flowchart 300 of a process for creating an account by transferring input data associated with the account to a server. The input data sent to the server includes image data that will ultimately be displayed on an LED display 140 using the bicycle wheel light display system 100. The input data includes location data which sets the geographic location where the image data will be displayed. When an LED display is present in the geographic location specified in the account, the image file associated with the account will be transmitted to the LED display. The process shown in flowchart 300 involves steps at a computer and a server.

[0055] At a first step 310, a computer receives account name data through a computer user interface. Next, at step 312, the computer receives central location data and radius data through a computer user interface. Together the central location data and radius data define geographic area. The central location of the geographic area is defined by the central location data 154 and the perimeter of the geographic area is defined by the radius data (as described in Figure 13). At step 314, the computer receives image data through a computer user interface. An example of image data includes an image file which includes color data and brightness data. The image file associated with the account will be transmitted to an LED display that falls within the geographic area entered in the account in step 312. At step 316, the computer receives start time data and stop time data from the user account database

[0056] An example of time data includes a time range at which the image data will be displayed on an LED display that falls within the geographic area. At step 318, the computer receives color data and animation data through a computer user interface. The color data is indicative color capability of the LED display. The animation data is indicative of the animation capability of the LED display. At step 319, the computer receives payment data through a computer user interface. In one example, payment data includes Paypal account information. In another example, payment data includes bank account number and a bank routing number.

[0057] In one embodiment, the computer user interface in Steps 310–319 is a webpage (as further discussed in Figure 2).

[0058] At step 320, a computer transceiver transmits the input data associated with the account from the computer to the server. At step 330, the server receives the input data (from steps 310–319) at the server transceiver. Additionally, at step 330, the server associates the input data (from steps 310–319) with a user account ID. The user account ID serves as a unique identifier for account data. After the server receives the input data associated with the account, at step 340 the server stores the input data on the server memory. The input data associated with the account is saved as an account data file on the server memory.

[0059] Figure 4 illustrates a user interface 400 of a smartphone according to an embodiment of the present invention. The user interface 400 includes a Setup button 410 and Start button 420. The user interface 400 is a touch-sensitive display for selecting one of the buttons 410 or 420.

[0060] In operation, the Setup button 410 opens a Setup user interface (as further discussed in Figure 5) and initiates a process for inputting data representing an LED display which is used in the bicycle wheel display system 100. The Start button 420 opens a LED display trip user interface (as further discussed in Figure 9). The Start button 420 initiates a process where the LED display receives image data from the server through the smartphone (as further discussed in Figure 8). Additionally, the Start button 420 initiates the LED display trip.

[0061] In another embodiment, the smartphone receives voice data through a microphone. The voice data can include voice commands to initiate the processes that are also initiated by pressing button 410 or 420.

[0062] Figure 5 illustrates a Setup user interface 500 for a smartphone according to an embodiment of the present invention. The Setup user interface 500 includes a Re-Link button 530, a Re-Try button 545, and an Edit Button 565. Additionally, the Setup user interface 500 includes an LED display model field 505, an LED display color field 510, an LED display animation field 515, an LED display power field 520, and an LED display communication field 525. The Setup user interface 500 further includes a server communication field 535 and an account status field 540. The Setup user interface 500 also includes an account name field 550, an account payment balance field 555, and a payment method field 560. The Setup user interface 500 is a touch-sensitive display for selecting one of the buttons 530, 545, or 565. The data input fields 505, 510, 515, 520, and 525 on the Setup user interface 500 receive input data from the LED display memory. The data input fields 550, 555, and 560 on the Setup user interface 500. The data input fields 535 and 540 receive input data from the server.

[0063] In operation, the Re-Link button 530 initiates a process for establishing a wireless communication link between the smartphone 120 and the LED display 140 (as further discussed in Figure 1A). After establishing a wireless communication link between the smartphone and LED display, the Setup user interface 500 receives data representing the LED display system. Data representing the LED system is stored in the LED display memory. The data representing the LED display system is transferred from the LED display memory to the smartphone through the wireless communication link. The data representing the LED display system includes LED display model data. The data LED display model data is entered in the LED display model field 505. The data representing the LED display also includes the LED display color capability data. The LED display color capability data is entered in the LED display color field 510. The data representing the LED display model further includes the LED display animation data. The LED display animation data is entered in the LED display animation field 515. The data representing the LED display model also includes LED display power level data. The LED display power level data is entered in the LED display power field 520.

[0064] In one embodiment, the LED display color capability data includes data that indicates a color capability of monochrome, 16+ colors, 256 colors, or 256+ colors.

[0065] In another embodiment, the data representing the LED display system further includes an LED display minimum speed field. The LED display minimum speed data is entered in the LED display minimum speed field.

[0066] In another embodiment, the LED display animation data includes data that indicates that an LED display is capable of displaying animation or that an LED display is not capable of displaying animation.

[0067] Additionally, after establishing a wireless communication link between the smartphone and the LED display, the LED display communication field 525 is populated with data indicating that there is a valid communication link. In one example, the LED display communication field 525 displays "Yes" when there is a valid communication link and "No" when there is not a valid communication link. If there is not a valid communication link between the smartphone and the LED display, by pressing the Re-Link button 530, the smartphone wireless transceiver attempts to re-establish a wireless communication link between the LED display and the smartphone.

[0068] In operation, the Re-Try button 545 initiates a process for establishing a wireless communication link between the smartphone 120 and the server 110 (as further discussed in Figure 1). Next, data representing the status of the wireless communication link between the smartphone and the server is transmitted to the smartphone. The data representing the status of the wireless communication link between the smartphone and the server is entered in the server communication field 535. In one example, if there is a wireless communication link between the smartphone and the server, the server communication field 535 displays "Yes". In another example, if there is not a wireless communication link between the smartphone and the server, the server communication field 535 displays "No". Furthermore, in operation, data representing the status of the user account is entered in the account status field 540. In one example, if there is an LED display account for the LED display, the account status field 540 displays "Valid". In another example, if there is not an LED display account for the LED display, the server communication field 535 displays "Invalid".

[0069] Additionally, in operation, the Edit button 565 initiates a process for entering text data representing details of a LED display account. Upon selecting the Edit button 565, the Setup user interface 500 allows text data to be entered on the touch-screen. The text data includes text data representing an account name. The text data representing an account name is entered in the account name field 550. The text data further includes data representing a method of receiving payment. The text representing a method of receiving payment is entered in the payment method field 560. In one example, the text data representing a method of receiving payment may include a bank account number and routing number. In another example, the text data representing a method of receiving payment may include PayPal account information. In addition, the Setup user interface 500 displays the balance of total payments received in the account payment balance field 555. The account payment balance field 555 is calculated based on the total amount paid for transmitting image files during all LED display trips.

[0070] In an alternative embodiment, the LED display model field, 505, the LED display color field 510, and the LED display animation field 515 may receive text data from the touch screen of the Setup user interface 500.

[0071] Figure 6 illustrates a flowchart 600 of a process for creating an account for an LED display by transferring input data to a server. The process of flowchart 600 establishes a wireless communication link between a smartphone and a server after input data is entered in the Setup user interface 500. The process is executed by the bicycle wheel display system 100 (as further discussed in Figure 1).

[0072] First, at step 610, the smartphone receives setup input data (as detailed in Figures 4 and 5) to create an LED display account through the Setup user interface 500. The setup input data represents details of the LED display account. For example, details of the LED display account may include an account name data and payment data. At step 620, the smartphone establishes a wireless communication link with the LED display. Next, at step 630 the smartphone receives data from LED display memory (as detailed in Figure 1C) through the wireless communication link. The data received from the LED display memory includes data representing the LED display system. Data representing the LED display system includes LED display model data, LED display color data, minimum speed data, and LED display animation data (as detailed in Figure 1C).

[0073] At step 640, the smartphone transceiver transmits the input data and the data representing the LED display system from the smartphone to the server. Next, at step 645, the server transceiver receives the input data and the data representing the LED display system. After receiving the data, at step 650 the server associates the input data and the data representing the LED display system with an LED display ID. An LED display account is created in the server memory and is associated with the LED display ID. The LED display ID identifies the LED display account in the LED display database and provides a unique identifier for locating data associated with the LED display account. At step 660 the server stores the input data and the data representing the LED display system. The server stores the data on the server memory.

[0074] In one embodiment, at step 620, the wireless communication link is established between the smartphone and the LED display is established using the smartphone wireless transceiver and the LED display wireless transceiver.

[0075] Figure 7 illustrates a flowchart 700 of a process for receiving and storing data representing the location of an LED display at the server. In the process, the location of the LED display is determined by sensing the GPS coordinates of a smartphone that is located proximate to the LED display. After sensing the GPS coordinates, the location of the LED display, represented by a set of GPS coordinates, is sent to the server. The process is executed by the bicycle wheel display system 100 (as further discussed in Figure 1).

[0076] First, at step 710, the smartphone establishes a wireless communication link with the LED display (as further discussed in Figure 8). The smartphone contains a GPS device (as further discussed in Figure 1) and is located proximate to the LED display. The GPS device is capable of determining location data representing the current location of the smartphone and, therefore, the current location of the LED display which is located proximate to the smartphone.

[0077] In one embodiment, the process of flowchart 700 is initiated by pressing a start button on the smartphone user interface (as further discussed in Figure 4). In one embodiment, the smartphone user interface is a Start button as displayed in Figure 4. Pressing the Start button on the smartphone user interface initiates the process for transmitting data representing the location of the smartphone from the smartphone to the server. Pressing the Start button also initiates the LED display trip, creating a new LED display trip ID which is stored in the LED display trip database on the server memory.

[0078] At step 720, the smartphone GPS determines the current LED display location data. Next, at step 730 the smartphone transceiver transmits the current LED display location data to the server through the wireless communication link. At step 740, the server transceiver receives the current LED display location data. After the server transceiver receives the current LED display location data, the server associates the LED display location data with an LED display trip ID at step 745.

For all "associates"

what does this mean?

[0079] At step 750 the Server determines the time the LED display location data was received at the server and stores as current time data. The server contains a clock and server memory (as further detailed in Figure 1B). The current time data is obtained from the server clock.

[0080] Next, at step 760 the server stores the current time data and the current LED display location data in the server memory. The current time data and the current LED display location are associated with an LED display trip ID when they are stored in the LED display trip database (as detailed in Figure 1B). The process represented by steps 720–760 of flowchart 700 is repeated every second.

[0081] In another embodiment, at step 760 the server data processor uses the current time data and the LED display location data to calculate the speed of the LED display. In this embodiment, after receiving the LED display location data and determining the current time data, the server data processor calculates the LED display speed by comparing the current time data and the the LED display location data to the LED display location data received by the server one second earlier. First, the data processor determines the distance traveled during the one second time-period by determining the distance between two LED display location data: the LED display location data just received and the LED display location data received one second earlier. Next, the data processor divides the distance traveled during the one second period by the one second time-period to calculate the speed of the LED display. The LED display speed data is associated with the LED display trip ID and is stored in the LED display trip database. The data processor of the server repeats this process each time new LED display location data is received at the server.

[0082] In another embodiment, at step 760, the LED display trip duration is calculated using the current time data. From the start of the LED display trip, one second is added to the LED display trip duration data each second. The updated LED display trip duration data is associated with an LED display trip ID and is stored in the LED display trip database.

[0083] In another embodiment, the LED display trip distance data is calculated using the LED display location data stored in the LED display trip database. The LED display trip distance data represents total distance traveled by the LED display during the LED display trip. Specifically, LED display trip distance data is calculated by adding the distance traveled each second to the LED display trip distance data. Each second the server data processor determines the distance traveled during the one second time-period by determining the distance between two LED display location data: the LED display location data just received and the LED display location data received one second earlier. After determining the distance traveled during the one second time-period, the server data processor adds this distance to the LED display trip distance data. The updated total distance traveled by the LED display is associated with the LED display trip ID stored as LED display trip distance in the LED display trip database.

[0084] Figure 8A and Figure 8B illustrate a flowchart 800 of a process for selecting image data to transmit to an LED display and transmitting the image data to the LED display. The process of flowchart 800 selects image data to transmit to the LED display based on the central location data, the radius data, the start time data, the stop time data, the color data, and the animation data in the user account database and the LED display color data, the LED display animation data, the LED display location data, and the current time data in the LED display database. The process is executed by the bicycle wheel display system 100 (as further discussed in Figure 1). Specifically, the image data selection process is executed at the server and the image file is then transmitted to the LED display using the smartphone.

[0085] First, at step 805, the smartphone receives a start indication by pressing a button on the smartphone user interface. In one embodiment, the smartphone user interface is a Start button as displayed in Figure 4. Pressing the button on the smartphone user interface indicates that the LED display in the bicycle wheel display system 100 is ready to receive image data and establishes the start of the LED display trip. During the LED display trip, the LED display is available for receiving image data. Additionally, pressing the Start button on the smartphone user interface initiates the process for transmitting image data to the LED display.

[0086] In one embodiment, after the smartphone receives the start indication in step 805, the server data processor records the LED display trip start time data from the server clock. The server associates the LED display trip start time data with an LED display ID. Additionally, the server associates the LED display trip start time with an LED display trip ID. Data associated with an LED display trip is associated with an LED display trip ID.

The server stores the LED display trip start time data in the LED display database on the server memory. The LED display trip start time data represents the time that the LED display was available for receiving image data from the server.

[0087] In another embodiment, after receiving the start indication by pressing a Start button on the smartphone user interface, step 805 also initiates the process of flowchart 700 (as further discussed in Figure 7). The process of flowchart 700 results in the current LED display location data being stored in the server memory every second. Each current LED display location data is associated with current time data which recorded from the server clock to indicate the time at which the current LED display location data was received at the server.

[0088] Next, at step 810 the smartphone senses the current LED display location data using the smartphone GPS. At step 815, the smartphone transmits the LED display location data to the server through a wireless communication link.

[0089] After the server receives the LED display location data, at step 820, the server associates the LED display location data with an LED display trip ID. The server then records the time that the LED display location data was received from the smartphone as current time data at Step 825. Both the LED display location data and current time data are associated with an LED display trip ID stored in the LED display database.

[0090] Next, at step 830, the server data processor queries the user account database (as detailed in Figure 1B) in the server memory to retrieve user account ID data, central location data, and radius data. In the user account database, the central location data and radius data are associated with user account ID data. Together, the central location data and radius data define the perimeter of a geographic area (as described in Figure 13). After retrieving the central location data and the numerical radius, at Step 835, the server data processor calculates the distance between the central location data and the LED display location data. Upon calculating the distance between the central location data and the LED display location data, at step 840, the server data processor compares the distance between the central location data and the LED display location data to the radius data (as described in Figure 13).

[0091] If the distance between the central location data and the LED display location data is greater than the radius data, then the process proceeds to step 845. If the distance between the central location data and the LED display location data is greater than the radius data, then the location of the LED display is outside the perimeter of the geographic area defined by the central location data and radius data. At step 845, the server does not transmit the image data from the server user account database to the smartphone. As a result, the LED light bank on the LED display is not activated in response to image data.

[0092] If the distance between the central location data and the LED display location data is less than or equal to the radius data, then the process proceeds to steps 850–899. If the distance between the central location data and the LED display location data is less than or equal to the radius data, then the location of the LED display is inside perimeter of the geographic area defined by the central location data and radius data.

[0093] Next, at step 850, the server data processor retrieves color data and animation data associated with the user account ID data. Additionally, at step 850, the server data processor retrieves LED display color data and LED display animation data associated with the LED display trip ID. At step 855 the server data processor determines whether the LED display system associated with the LED display ID is capable of displaying the image file associated with the user account ID. To make this determination, the server data processor compares the color data associated with the user account ID to the LED display system color data associated with the LED display ID. Additionally, the server data processor compare the animation data associated with the user account ID to the LED display system animation data associated with the LED display ID.

[0094] In one example of step 855, the color data associated with the user account ID data may indicate that the LED display system displays in monochrome, 16+ colors, 256 colors, or 256+ colors. To be capable of displaying the image file, the LED display color data must be greater than or equal to the color data specified in the user account database. For example, if the user account database specifies 16+ colors for color data and the LED display color data in the LED display database is 16+ colors, 256 colors, or 256+ colors, then the LED display is capable of displaying the image file. In alternate example, if the color data specifies 16+ colors in the user account database and the LED display color data in the LED display database is monochrome, then the LED display is not capable of displaying the image file.

[0095] If the LED display is capable of displaying the image file associated with the user account ID, then the process proceeds to steps 865–899. If the LED display is not capable of displaying the image file associated with the second set of GPS coordinates, then the process proceeds to step 860.

[0096] At step 860, the server does not transmit the image data from the server user account database to the smartphone. As a result, the LED light bank on the LED display is not activated in response to image data.

[0097] At step 865, the server data processor retrieves start time data and stop time data associated with the user account ID from the server memory. Using the start time data and stop time data associated with the user account ID, the serve data processor determines whether the current time data is between the start time data and end time data. The current time is between the start time data and end time data if the current time data is greater than or equal to the start time data.

[0098] If the current time data is not between the start time data and the end time data, then the process proceeds to step 875. At step 875, the server does not transmit the image data from the server user account database to the smartphone. As a result, the LED light bank on the LED display is not activated in response to image data.

[0099] If the current time data is between the start time data and the end time data, then the process proceeds to step 880–899. At step 880, the server retrieves image data associated with the user account ID from the user account database in the server memory. The server data processor queries the user account database for the image data based on the user account ID data. Next, at step 885, the server transceiver transmits the image data associated with the user account ID data to the smartphone transceiver over a network connection between the smartphone and the server.

[00100] In the current embodiment, the process of flowchart 800 illustrates a process for retrieving image data to transmit to and LED display when one user account satisfies the criteria of steps 835–875. Figure 10 illustrates a process for retrieving image data to transmit to an LED display when multiple user accounts satisfy the criteria of steps 835–875.

[00101] In one embodiment, the image data transmitted to the smartphone at step 885 is an animation file. In another embodiment, the image data transmitted to the smartphone at step 885 is a still image file.

[00102] At step 890, the smartphone establishes a wireless communication link with the LED display using a wireless transceiver in the smartphone and a wireless transceiver in the LED display. In one embodiment, the wireless transceiver in the smartphone and the wireless transceiver in the LED display are Bluetooth communication devices.

[00103] Next, at step 895, the smartphone transmits the image data associated with the user account ID to the LED display through the wireless communication link. In one embodiment, the smartphone transmits the image data to the LED display for a duration of 30 seconds. After receiving the image data, the LED display activates the LED light bank in response to the image data at step 895. In one embodiment, at step 895, the LED light bank of the LED display is activated in response to the image data for a duration of 30 seconds.

[00104] Steps 830–895 repeat every 30 seconds. As a result, the server sends new image data to display every 30 seconds based on the process 800. In one embodiment, the server data processor the counts the number of image files that are transmitted to the LED display (as further discussed in Figure 9) and stores that number in the LED display file on in the LED display database in the server memory.

[00105] At step 899, the smartphone receives a stop indication by pressing a button on the smartphone user interface. In one embodiment, the smartphone user interface is a Stop button as displayed in Figure 9. Pressing the Stop button on the smartphone user interface terminates the Steps 810–895 in process for transmitting image data to the LED display.

[00106] In another embodiment, receiving a stop indication by pressing the Stop button on the smartphone user interface, step 899 also terminates the process of flowchart 700 (as further discussed in Figure 7). Upon terminating the process of flowchart 700, the smartphone GPS stops sensing the current LED display location data and stops transmitting the current LED display location data to the server.

[00107] In one embodiment, after the smartphone receives the start indication in step 899, the server data processor records the LED display trip stop time data from the server clock. The server associates the LED display trip stop time data with an LED display trip ID. Additionally, the server associates the LED display trip stop time with an LED display trip ID. The server stores the LED display trip stop time data in the LED display database on the server memory. The LED display trip stop time data represents the time that the LED display was no longer available for receiving image data from the server.

[00108] In another embodiment, at step 899, the server data processor calculates the LED trip duration. To calculate the LED trip duration, the server data processor calculates the amount of time between the LED display trip start time and the LED display trip stop time data. The difference between the LED display trip stop time data and LED display trip stop time data is used to populate the LED display trip duration data. The LED display trip duration data is associated with the LED display trip ID and is stored in the LED display database on the server memory.

[00109] Figure 9 illustrates a flowchart 900 of a process for calculating payment for transmitting image data to an LED display. Payment data includes the total ad budget remaining after transmitting image data to an LED display and the total amount earned by receiving images at an LED display. The process of flowchart 900 also calculates the total ad count which represents the number times image data has been transmitted to an LED display.

[00110] First, at step 905, the server transceiver transmits image data to an LED display. Figures 8A and 8B provide further details on the process for transmitting image data to an LED display. Next, at step 910, the server determines (1) the user account ID data associated with the image data that was transmitted to the LED display and (2) the LED display trip ID associated with the LED display trip. At step 915, the server queries the server memory based on the user account ID data to retrieve the max ad price data and the total ad budged data from the user account database.

actually, start at a low value + only bid up to MAX

[00111] After retrieving the max ad price data and the total ad budget data, the server subtracts the max ad price data from the total ad budget data at step 920. Subtracting the maximum ad price data from the total ad budget data calculates the total ad budget remaining after transmitting the image data to the LED display. At step 925, the server saves the updated total ad budget data in the user account database. The server saves the updated total ad budget data with the corresponding user account ID data.

[00112] Next, at step 930, the server queries the server memory based on the LED display trip ID data to retrieve the total amount earned data and the total ad count data. At step 940, the total amount earned data and the total ad count data are stored in the LED display trip database on the server memory. In the LED display trip database, the total amount earned data and the total ad count data are associated with an LED display trip ID. After retrieving the total amount earned data and the total ad count data, at step 935, the server data processor adds 1 to the total ad count data. After updating the total ad count data, at step 940 the server adds the max ad price data to the total amount earned data. The server then saves the updated total amount earned data in the LED display database at step 950. In the LED display trip database, the total ad count data and the total amount earned data are associated with an LED display trip ID in the LED display trip database. In one embodiment, the total amount earned and the total ad count are displayed on a smartphone user interface (as further discussed in Figure 11).

[00113] In another embodiment, the process of flowchart 900 also uses LED display speed data to determine payment data for an LED display trip. In this embodiment, the server data processor uses the current time data and the LED display location data to calculate the speed of the LED display (current time data and LED display location data are described further in Figure 7). Current time data and LED display location data are recorded every second during an LED display trip. The server data processor determines the distance traveled during the one second by determining the distance between two consecutive LED display location data: the LED display location data just received and the LED display location data received one second earlier. Next, the data processor divides the distance traveled during one second by the one second to calculate the speed of the LED display. The LED display speed data is stored on the server memory in the LED display trip database and is associated with an LED display trip ID.

[00114] Next, to determine payment data for the LED display, the server data processor queries the LED display database to determine the minimum speed data associated with the LED display ID. The server also determines the LED display speed data associated with the LED display trip ID. The server determines, whether the LED display speed was less than the recommended minimum speed. If the LED display speed was less than the recommended minimum speed for the LED display for more than half of the 30 second duration when the image data is transmitted to the LED display, then the server does not subtract the max ad price data from the total ad budget data at step 920. Additionally, if the LED display speed was less than the recommended minimum speed for the LED display for more than half of the 30 second duration when the image data is transmitted to the LED display, the server does not add the max price data to the total amount earned at step 950.

[00115] In another embodiment, in the process of flowchart 900, the server queries the server memory to obtain the LED display trip duration data for the times when there is was no wireless communication link between the LED display and the smartphone. If there was no wireless communication link between the LED display and the for more than half of the 30 second duration when the image data is transmitted to the LED display, then the server does not add price data to the total amount earned.

[00116] In another embodiment, in the process of flowchart 900, in addition to querying the server memory to the max ad price data associated with the image data that is transmitted to the LED display, the server queries the server memory to obtain the duration of time during the LED display trip when there is was no wireless communication link between the smartphone and the server. If there was no wireless communication link between the smartphone and the server for more than half of the 30 second duration when the image data is transmitted to the LED display, then the server does not add max ad price data to the total amount earned data and does not subtract the max ad price data from the total ad budget.

[00117] Figure 10 illustrates an auction process 1000 for selecting image data to transmit to an LED display when multiple user accounts IDs are selected. Figure 8A details the process for selecting user account IDs to transmit image data to an LED display. The auction process of flowchart 1000 illustrates a process for selecting image data to transmit to and LED display when one user account satisfies the criteria of steps 835–875 in Figure 8A.

[00118] In step 1005, the server retrieves user account IDs from the server memory as detailed in Figure 8A. After retrieving the user IDs, the server determines the number user account IDs were retrieved at step 1010. If no user account IDs were retrieved, the process 1000 proceeds to step 1025. At step 1025, the server does not transmit image data to the LED display. If 1 user account ID was retrieved, the process 1000 proceeds to step 1020. At step 1020, the server transmits image data associated with the user account ID to the LED display as detailed in Figure 8B. If more than 1 user account ID was retrieved, the process 1000 proceeds to step 1015.

[00119] At step 1015, the server retrieves the max ad price data associated with the user account ID in the user account database. Next, at step 1030, the server determines the user account ID with the highest max ad price data. After determining the user account Id with the highest max ad price data, the server retrieves the image data associated with the user account ID. At step 1040, the server transceiver transmits the image data associated with the user account ID to the LED display.

[00120] At step 1045, the server determines whether the max ad price data was less than one dollar. If the max ad price data was not less than one dollar, the process 1000 proceeds to steps 1050 and 1060. If the max ad price data was less than one dollar, the process 1000 proceeds to steps 1055 and 1065.

[00121] At step 1050, the server subtracts the second highest max ad price data plus ten cents from the total ad budged data associated with the user account ID. Next, at step 1060, the server adds the second highest max ad price data plus ten cents from the total amount earned data associated with the LED display trip.

[00122] At step 1055, the server subtracts the second highest max ad price data plus ten cents from the total ad budged data associated with the user account ID. Next, at step 1065, the server adds the second highest max ad price data plus ten cents from the total amount earned data associated with the LED display trip.

[00123] Figure 11 illustrates an LED display trip user interface 1100 for the smartphone according to an embodiment of the present invention. The LED display trip user interface 1100 appears on the smartphone after initiating process detailed in Figure 8 (as further discussed Figure 4). The LED display trip user interface 1100 includes a Stop button 1195. Additionally, the LED display trip user interface 1100 includes a trip distance input field 1110, a trip duration input field 1120, an image count input field 1130, a total amount earned input field 1140, and a Speed Alert input field 1150. The LED display trip user interface 1100 further includes an LED display battery level field 1160, an LED display battery power field 1170, a wireless connection status field 1180, and a wireless connection strength field 1190. The LED display trip user interface 1100 is a touch-sensitive display for selecting the Stop button 1195.

[00124] In operation, the trip distance input field 1110 receives data representing the total distance traveled by the LED display since the start of the LED display trip. The trip distance input field 1110 receives data through a wireless communication link between the server and the smartphone. Every second, the server data processor queries the server memory based on the LED display trip ID to obtain the trip distance data which is stored in the LED display trip database on the server memory (as further detailed in Figure 1B).

[00125] The trip duration input field 1120 receives data representing the duration of the LED display trip. The trip duration input field 1120 receives data through a wireless communication link between the server and the smartphone. Every second, the server data processor queries the server memory based on the LED display trip ID to obtain trip duration data which is stored in the LED display trip database on the server memory (as further detailed in Figure 1B).

[00126] The image count input field 1130 receives data representing the number of images that have been displayed on the LED display since the start of the LED display trip. The image count input field 1130 receives data through a wireless communication link between the server and the smart phone. Every 30 seconds, the server data processor queries the server memory based on the LED display trip ID to obtain total ad count data which is stored in the LED display trip database on the server memory (as further detailed in Figure 1B).

[00127] The total amount earned input field 1140 receives data representing the total amount paid to transmit image data to the LED display. Each time an image is transmitted to an LED display, the max ad price data associated with the image data is added to the total amount earned data in the LED display trip database (as further detailed in Figure 9). The total amount earned input field 1140 receives data through a wireless communication link between the server and the smartphone. Every 30 seconds, the server data processor queries the server memory based on the LED display trip ID to obtain the total amount earned data which is stored in the LED display trip database (as further detailed in Figure 1B).

[00128] Further describing the operation of the LED display trip user interface 1100, the Speed Alert input field 1150 receives input data from the server. The server data processor calculates the LED display speed based on GPS data and time data collected from the smartphone GPS (as further discussed in Figure 7). The server data processor compares the LED display speed to the minimum recommended speed associated with the LED display in the LED display file. If the calculated LED display speed is less than the recommended minimum speed, the Speed Alert input field 1150 receives text data representing a speed alert.

[00129] In operation the LED display battery level field 1160 receives data representing the charge level of the LED display battery. The LED display battery charge level field 1160 displays a status bar representing the remaining LED display battery charge inside a battery icon in the battery charge level field. The LED display trip user interface 1100 receives data representing the charge level of the LED display battery from the LED display battery through a Bluetooth communication link.

[00130] In operation, the LED display battery power field 1170 receives data representing the percentage of power remaining in the LED display battery. The LED display battery power level field 1170 displays the percentage for remaining power. The LED display trip user interface 1100 receives data representing the percentage of power remaining in the LED display battery from the LED display battery through a Bluetooth communication link.

[00131] In operation, the wireless connection status field 1180 displays data representing the status of the wireless communication link between the smartphone and the LED display. The wireless connection status field 1180 receives input data from the smartphone wireless transceiver. If there is a wireless communication link between the smartphone and the LED display, the wireless connection status field 1180 displays a Bluetooth symbol. If there is not a Bluetooth communication link between the smartphone and the LED display, the wireless connection status field 1180 does not display a Bluetooth symbol.

[00132] Additionally, in operation the wireless connection strength field 1190 displays data representing the strength of the wireless communication link between the smartphone and the server. The wireless connection status field 1190 receives data from the smartphone transceiver. The strength of the wireless communication link is represented by a status bar icon in the wireless connection strength field 1190.

[00133] In operation, the Stop button 1195 when activated initiates a process for stopping the transmission of image data to the LED display. Pressing the Stop button 1195 terminates the LED display trip and indicates that the LED display is no longer available for receiving image data.

[00134] Figure 12 illustrates an Error user interface 1200 for the smartphone according to an embodiment of the present invention. The Error user interface 1200 includes an Error text field 1210.

[00135] In operation, the Error text field 1210 displays text data representative of an error with a process operating on the bicycle wheel light display system 100.

[00136] In one embodiment, the Error text field 1210 displays the message "No Spoke System Detected". The "No Spoke System Detected" displays on the smartphone user interface when, after pressing the Start button (as further discussed in Figure 4), there is no LED display system located proximate to the smartphone.

[00137] In another embodiment, the Error text field 1210 displays the message "Connection lost with Spoke System". The "Connection lost with Spoke System" message displays on the smartphone user interface when, after pressing the Start button (as further discussed in Figure 4), there is no Bluetooth communication link between the LED display and the smartphone.

[00138] In another embodiment, the Error text field 1210 displays the message "Spoke System out of Power". The "Spoke System out of Power" message displays on the smartphone user interface when, after pressing the Start button (as further discussed in Figure 4), the battery of the LED display is out of power.

[00139] In another embodiment, the Error text field 1210 displays the message "Connection Lost with TheSpin". The "Connection Lost with TheSpin" message displays on the smartphone user interface when, after pressing the Start button (as further discussed in Figure 4), there is no wireless communication link between the smartphone and the server.

[00140] In another embodiment, the Error text field 1210 displays the message "Invalid Account". The "Invalid Account" message displays on the smartphone user interface when, after entering input data into the Setup user interface (as further discussed in Figure 5), a piece of input data is missing.

[00141] Figure 13 illustrates a geographic area 1300 as defined by the central location data and the radius data in the user account. The geographic area 1300 of Figure 13 includes a perimeter 1310, a central location 1320, a radius 1330, an LED display 1340, and a LED display distance 1350. The geographic area 1300 represents a geographic area that is selected by a user such that, when an LED display is located within the geographic area, image data is transmitted from a server to the LED display. The perimeter 1310 represents the perimeter of the geographic area selected by the user. The central location 1320 is defined by a set of GPS coordinates that represent the center of the geographic area selected by the user. The radius 1330 represents the distance from the central location to the perimeter 1310 of the geographic area 1300. The LED display distance 1350 represents the distance from the central location 1320 to the LED display 1340. The LED display 1340 represents an LED display mounted on a bicycle wheel that receives image data from a server when it is located inside the geographic area 1300.

[00142] In operation, when an LED display is located inside the geographic area (as described in Figure 8A and 8B), a server transmits image data to the LED display 1340 and the LED display 1340 is activated in response to receiving the image data. If the LED display distance 1350 is greater than the radius 1340, then the LED display is located outside the perimeter of the geographic area selected by the user and image data is not transmitted to the LED display 1340. If the LED display distance 1350 is less than the radius 1340, then the LED display is located inside the perimeter of the geographic area selected by the user and image data is transmitted to the LED display 1340.

[00143] In another embodiment of the invention, the server sends a notification to the smartphone using the bicycle wheel LED display system 100. The notification includes text data representing a message. The text data representing a message is displayed on the smartphone user interface. The smartphone user interface receives the notification from the server through a wireless communication link between the server and smartphone. An example notification displays the message "Go for a Trip" on the smartphone user interface. The notification indicates that there a user account ID that is stored in the user account database that is available be transmitted the LED display. Figure 8A and 8B detail the process for selecting image data that is available to transmit to the LED display. If image data is available in the user account database on the server and a smartphone is present in the geographic area (see Figure 13) that is associated with the user account ID, then the server sends a notification to the smartphone to indicate that an image data is available.

need a little more here - w/ is it sent?

[00144] In an alternative embodiment of the invention, the server creates a route for an LED display which maximizes the total amount earned during an LED display trip. As described in Figure 1A, the LED display is connected to a bicycle wheel and is located proximate to a smartphone. In this embodiment, the smartphone transmits the current LED display location to the server (as described in Figure 7). In addition, the destination of the bicycle to which the LED display is attached is entered through the smartphone user interface and is transmitted to the server. The server calculates a route for the LED display trip. The route is defined by GPS coordinate data that starts at the current LED display location and ends at the destination. The server data processor determines routes based on the current location of the LED display and the destination. The server data processor uses the central location data, the radius data, the start time data, the stop time data, and the max ad price data associated with all user account IDs in the user account database to calculate

How?

the total amount earned for different routes from the current LED display location to the destination. The server determines the route that maximizes the amount earned during the LED display trip and transmits that route to the smartphone. In one example, the route can be two points or a loop.

[00145] In another embodiment, the server data processor calculates a destination for an LED display that maximizes the amount earned during the LED display trip. As described in Figure 1A, the LED display is connected to a bicycle wheel and is located proximate to a smartphone. In this embodiment, the smartphone transmits the current LED display location to the server (as described in Figure 7) and the server records current time data (as described in Figure 7). In addition, an LED trip duration is entered in the smartphone user interface and is transmitted to the server. The server then determines a destination for the bicycle to which the LED display is attached and transmits the destination to the server. The server determines a destination that will maximize the total amount earned during the LED display trip based on the current time, the LED display location, and the trip duration. The server data processor uses the central location data, the radius data, and the max ad price data associated with all user account IDs in the user account database to calculate the total amount earned for LED display trips to different destinations and selects a destination that maximizes the total amount earned.

[00146] In another embodiment, the server processor calculates a time for an LED trip which maximizes the total amount earned during an LED display trip. As described in Figure 1A, the LED display is connected to a bicycle wheel and is located proximate to a smartphone. In this embodiment, the smartphone transmits the current LED display location to the server (as described in Figure 7). In addition, a LED trip destination is entered in the smartphone user interface and is transmitted to the server. The server then determines a start time that will maximize the total amount earned during the LED display trip. The server determines a destination that will maximize the total amount earned during the LED display trip based on the destination, the LED display location, and the trip duration. The server data processor uses the central location data, the radius data, the start time data, the stop time data, and the max ad price data associated with all user account IDs in the user account database to calculate the total amount earned for LED display trips at different start times and selects a start time that maximizes the total amount earned.

[00147] Existing bicycle wheel LED display systems either include image data that is pre-downloaded on the system or may be transmitted over a wireless communication link from a mobile communication device to the LED display system. However, these systems to not update image data that is transmitted to the bicycle wheel display based on the current location of the bicycle. As a consequence, a user cannot control what image data is activating the bicycle wheel LED display based on where the bicycle is located.

OK - at least some motivation - could be better

[00148] While particular elements, embodiments, and applications of the present invention have been shown and described, it is understood that the invention is not limited thereto because modifications may be made by those skilled in the art, particularly in light of the foregoing teaching. It is therefore contemplated by the appended claims to cover such modifications and incorporate those features which come within the spirit and scope of the invention.

CLAIMS

1. A method of transmitting image data to a bicycle wheel light emitting diode (LED) display based on ~~the~~ location data received from a smartphone located proximate to said bicycle wheel LED display, said method including:

determining a perimeter of a geographic area, wherein said perimeter of said geographic area includes a predetermined numerical radius surrounding a central location;

determining a location of a bicycle wheel LED display by receiving a location data from a smartphone, wherein said smartphone is positioned proximate to said bicycle wheel LED display, wherein said smartphone includes a global positioning system (GPS) sensor and a wireless transceiver, wherein said bicycle wheel LED display includes an LED light bank and a wireless transceiver, wherein said bicycle wheel LED display is in wireless communication with said smartphone;

transmitting image data to said bicycle wheel LED display when said location data from said smartphone is inside said perimeter of said geographic area;

activating a plurality of LED lights on said LED light bank in response to receiving said image data.

2. The method of claim 1, wherein said image data includes data representing a still image.

3. The method of claim 1, wherein said image data includes data representing an animation.

4. The method of claim 1, wherein said image data is in a format selected from a list including: .jpg, .png, .avi, and .mov.

5. The method of claim 1, wherein said LED light bank includes a plurality of LED lights capable of displaying 16 or more colors.

6. The method of claim 1, wherein said LED light bank includes a plurality of LED lights capable of displaying 256 or more colors.

7. The method of claim 1, wherein said bicycle wheel LED display is affixed to the spoke system of a bicycle.

8. The method of claim 1, wherein said method further includes:

providing a data representing a time to start transmitting said image data to said bicycle wheel LED display;

providing a data representing a time to stop transmitting said image data to said bicycle wheel LED display; and

transmitting said image data to said bicycle wheel LED display based, in part, on said data representing said time to start transmitting said image data to said bicycle wheel LED display and, in part, on time data representing said time to stop transmitting image data to said bicycle wheel LED display.

9. The method of claim 1, wherein said method further includes:

providing data representing at least one feature of said bicycle wheel LED display, wherein said feature is selected from a list including: animation capability, color capability, minimum recommended bicycle speed; and

transmitting said image data to said smartphone based, in part, on said data representing said feature of said bicycle wheel LED display.

10. The method of claim 1, wherein the method further includes:

determining a speed of said bicycle wheel LED display, wherein the speed is determined using said location of said smartphone and a data representing a current time; and

transmitting said image data to said smartphone based, in part, on the speed of said bicycle wheel LED display.

11. A system for transmitting image data to a bicycle wheel light emitting diode (LED) display, said system including:

a bicycle wheel LED display, wherein said bicycle wheel LED display includes a wireless transceiver in communication with a smartphone;

a smartphone, wherein said smartphone includes a global positioning system (GPS) sensor and a wireless transceiver, wherein said smartphone is positioned proximate to said bicycle wheel LED display;

a computer, wherein said computer includes a user interface; and

a server, wherein said server is connected to said computer through a communication link, wherein said server is connected to said smartphone through a wireless communication link, wherein said server receives an image data, a central location data, and a predetermined numerical radius data from said computer, wherein said central location data and said predetermined numerical radius data define a perimeter of a geographic area, wherein said server receives a location data from said smartphone, wherein said server transmits said image data to said smartphone if the distance between said central location data and said location data from said smartphone is less than the predetermined numerical radius data, wherein said smartphone transmits said image data to said bicycle wheel LED display.

12. The system of claim 11, wherein said server further includes a data transceiver.

13. The system of claim 11, wherein said server further includes a data storage unit.

14. A method for selecting an image data to transmit from a server to a bicycle wheel light emitting diode (LED) display, said method including:

providing a smartphone, wherein said smartphone includes a global positioning system (GPS) sensor and a wireless transceiver;

providing at least one bicycle wheel LED display, wherein said smartphone is located proximate to said bicycle wheel LED display, wherein said bicycle wheel LED display includes a wireless transceiver in wireless communication with said smartphone;

providing a server, wherein said server is in communication with said smartphone;

providing a computer, wherein said computer is in communication with said server;

receiving a plurality of image data to transmit to said bicycle wheel LED display, wherein said image data is received by said server from said computer, wherein said image data is associated with a data representing a price for transmitting said image data to said bicycle wheel LED display and a data representing a geographic area; and

receiving a data representing a location of said bicycle wheel LED display, wherein said data representing said location of said bicycle wheel LED display is determined by said smartphone, wherein said data representing the location of said bicycle wheel LED display is received by said server;

determining image data to transmit said bicycle wheel LED display based on said data representing said location of the LED display, said data representing said geographic area, and said data representing said price for transmitting said image data to said bicycle wheel LED display.

15. The method of claim 14, wherein said bicycle wheel LED display is activated in response to receiving said image data.

16. The method of claim 14, wherein method further includes:

receiving a data representing the color capability of said bicycle wheel LED display; and

determining image data to transmit to said bicycle wheel LED display based on said data representing the color capability of said bicycle wheel LED display.

17. The method of claim 14, wherein method further includes:

receiving a data representing the animation capability of said bicycle wheel LED display; and

determining image data to transmit to said bicycle wheel LED display based on said data representing the animation capability of said bicycle wheel LED display.

ABSTRACT

Systems and methods are provided for transmitting image data to a bicycle wheel LED display. In the aforementioned systems and methods, image data is transmitted to a bicycle wheel LED display when the bicycle wheel LED display is in a predetermined location. Other embodiments of the aforementioned systems and methods utilize an auction process that utilizes the predetermined location to select a bicycle wheel LED display to receive image data. Additional embodiments of the aforementioned methods transmit image data to a bicycle wheel LED display at a predetermined time in addition to the predetermined location. Additional embodiments of the aforementioned methods transmit image data to a bicycle wheel LED display based on a predetermined time and a predetermined price for transmitting the image data. In all embodiments, the bicycle wheel LED display is activated in response to receiving image data.

190 words
MAY

Figure 1A

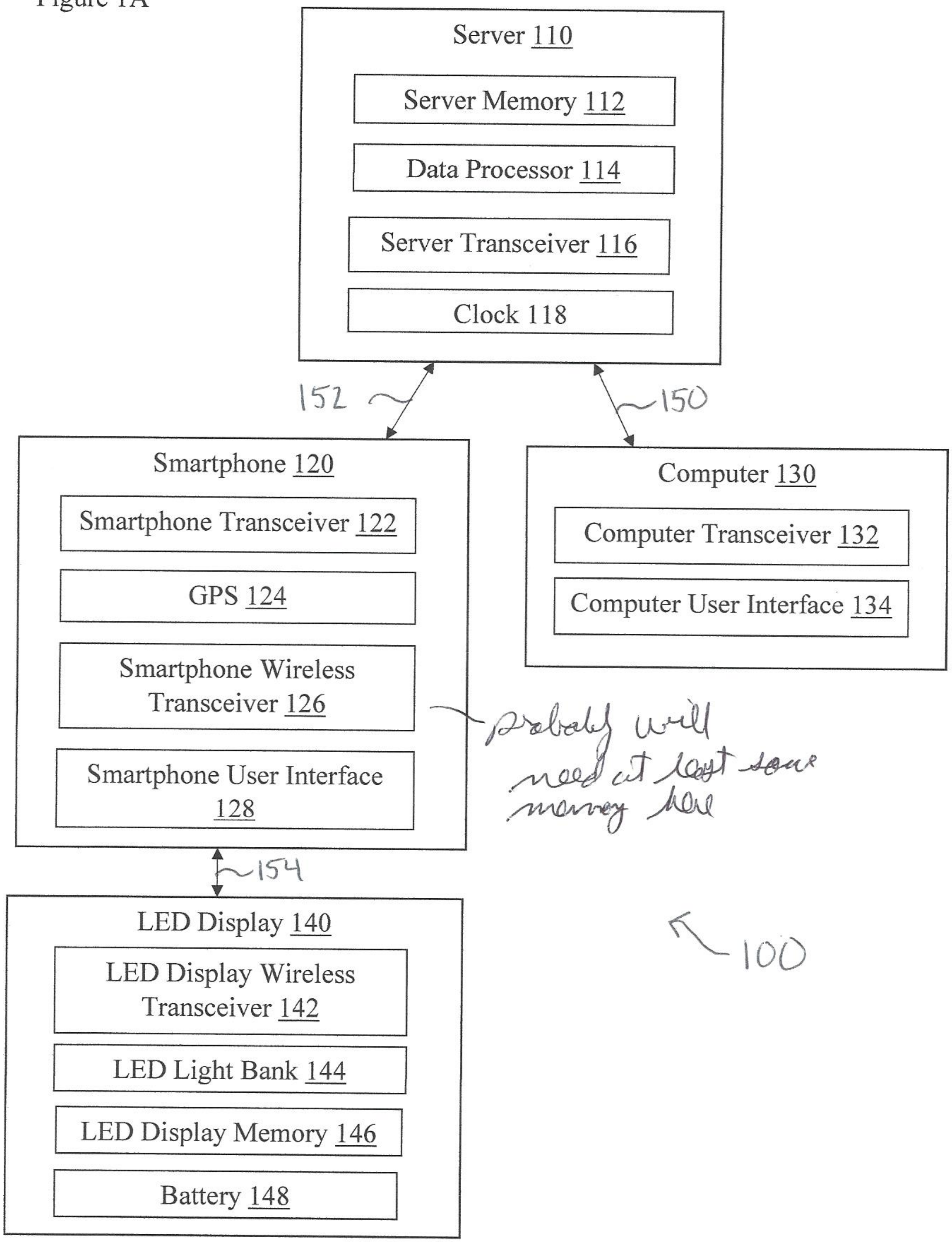

Server 110
Server Memory 112
Data Processor 114
Server Transceiver 116
Clock 118
152
150
Smartphone 120
Smartphone Transceiver 122
GPS 124
Smartphone Wireless Transceiver 126
Smartphone User Interface 128
Computer 130
Computer Transceiver 132
Computer User Interface 134
probably will need at least some memory here
154
LED Display 140
LED Display Wireless Transceiver 142
LED Light Bank 144
LED Display Memory 146
Battery 148
100

Figure 1B

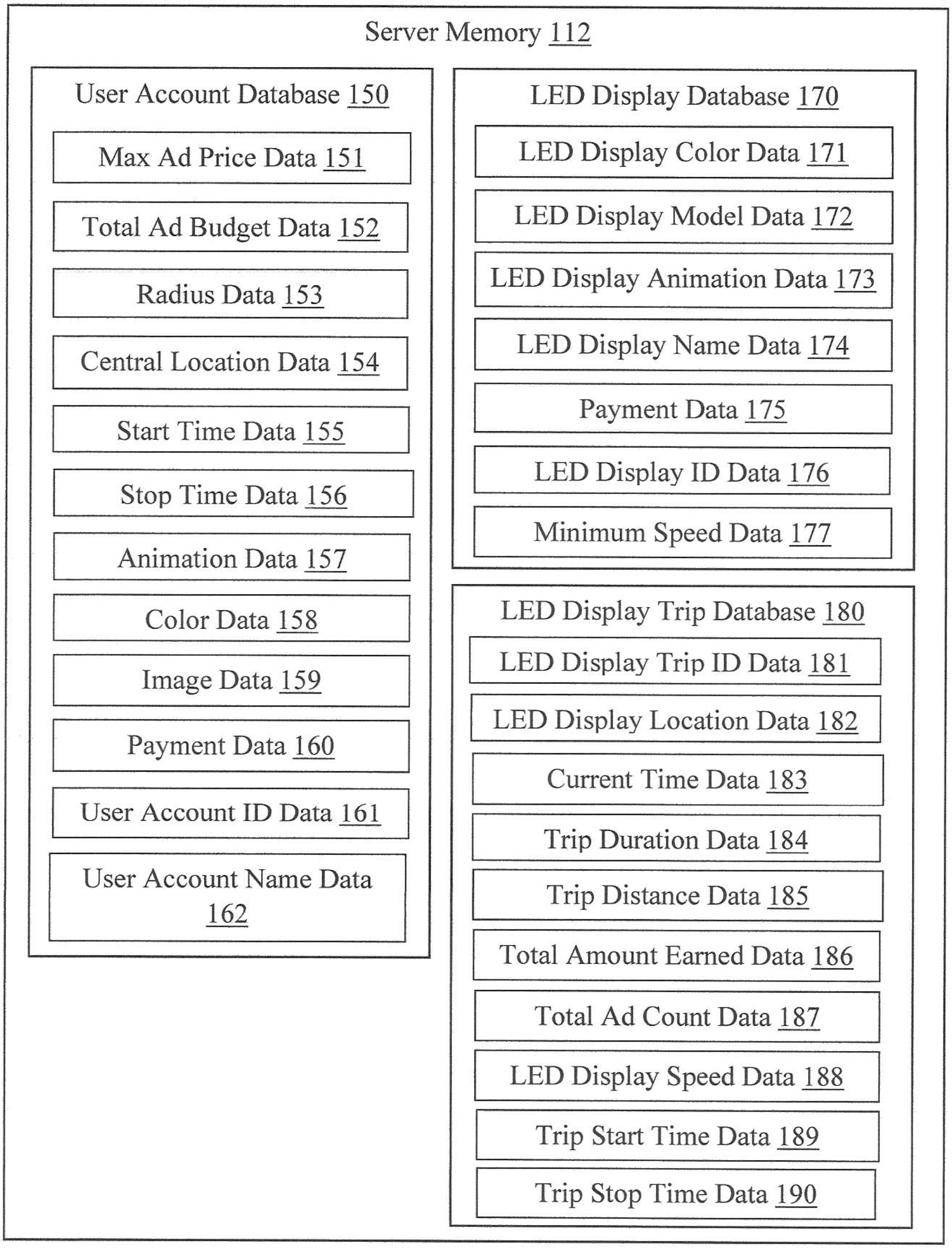

Server Memory 112
User Account Database 150
Max Ad Price Data 151
Total Ad Budget Data 152
Radius Data 153
Central Location Data 154
Start Time Data 155
Stop Time Data 156
Animation Data 157
Color Data 158
Image Data 159
Payment Data 160
User Account ID Data 161
User Account Name Data 162
LED Display Database 170
LED Display Color Data 171
LED Display Model Data 172
LED Display Animation Data 173
LED Display Name Data 174
Payment Data 175
LED Display ID Data 176
Minimum Speed Data 177
LED Display Trip Database 180
LED Display Trip ID Data 181
LED Display Location Data 182
Current Time Data 183
Trip Duration Data 184
Trip Distance Data 185
Total Amount Earned Data 186
Total Ad Count Data 187
LED Display Speed Data 188
Trip Start Time Data 189
Trip Stop Time Data 190

Figure 1C

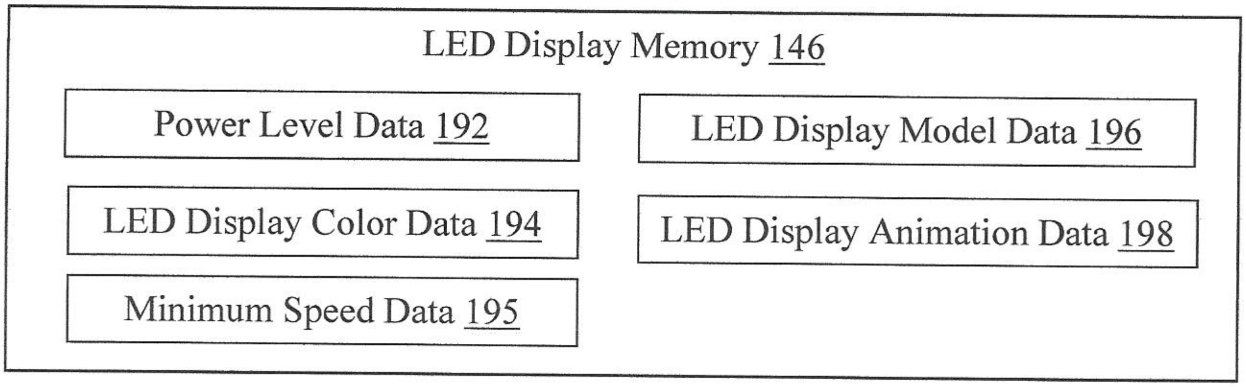

LED Display Memory 146
Power Level Data 192
LED Display Model Data 196
LED Display Color Data 194
LED Display Animation Data 198
Minimum Speed Data 195

Figure 2

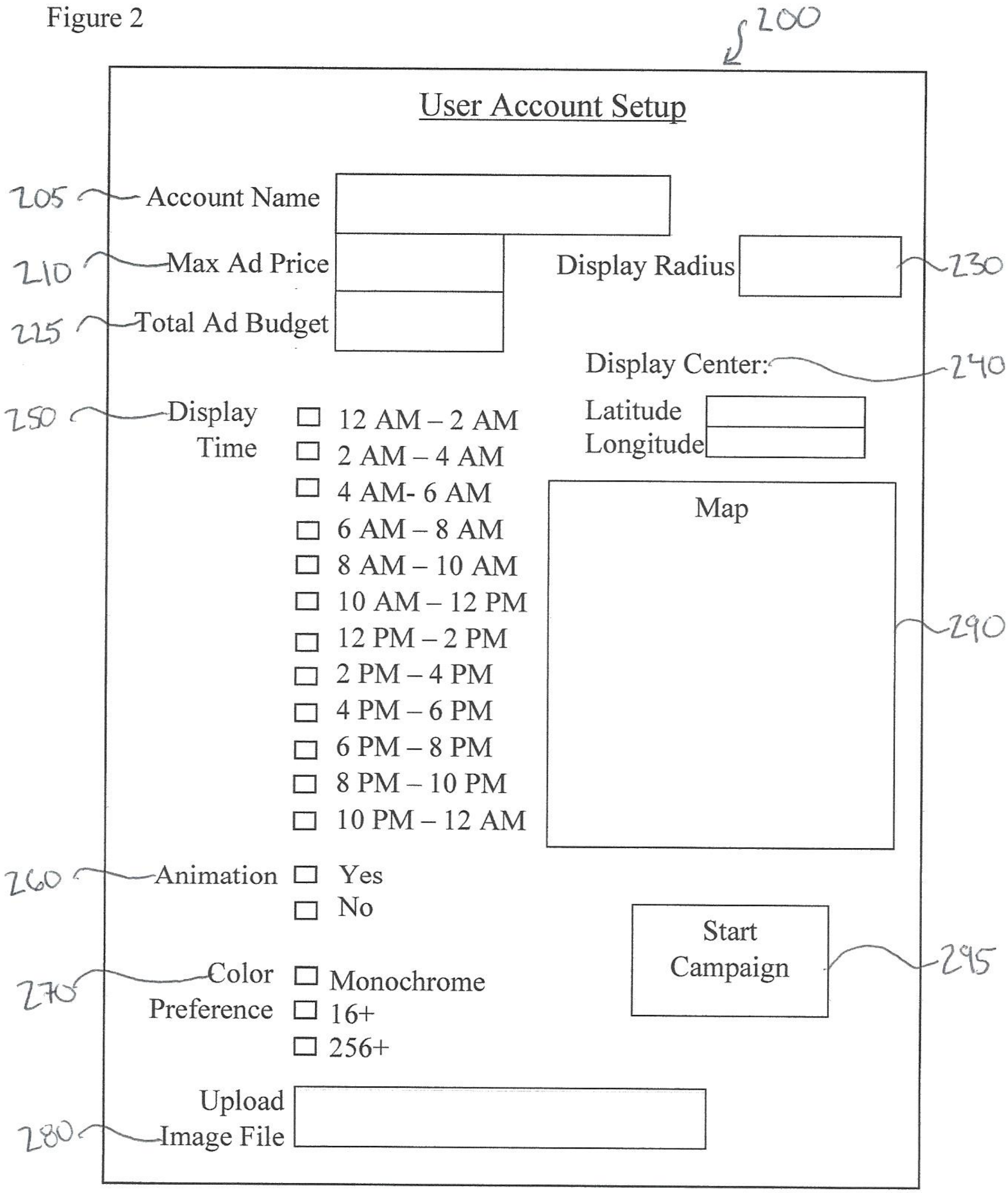

200
User Account Setup
205
Account Name
210
Max Ad Price
225
Total Ad Budget
Display Radius
230
Display Center:
240
Latitude
Longitude
250
Display Time
12 AM – 2 AM
2 AM – 4 AM
4 AM- 6 AM
6 AM – 8 AM
8 AM – 10 AM
10 AM – 12 PM
12 PM – 2 PM
2 PM – 4 PM
4 PM – 6 PM
6 PM – 8 PM
8 PM – 10 PM
10 PM – 12 AM
Map
290
260
Animation
Yes
No
Start Campaign
295
270
Color Preference
Monochrome
16+
256+
Upload Image File
280

Figure 3

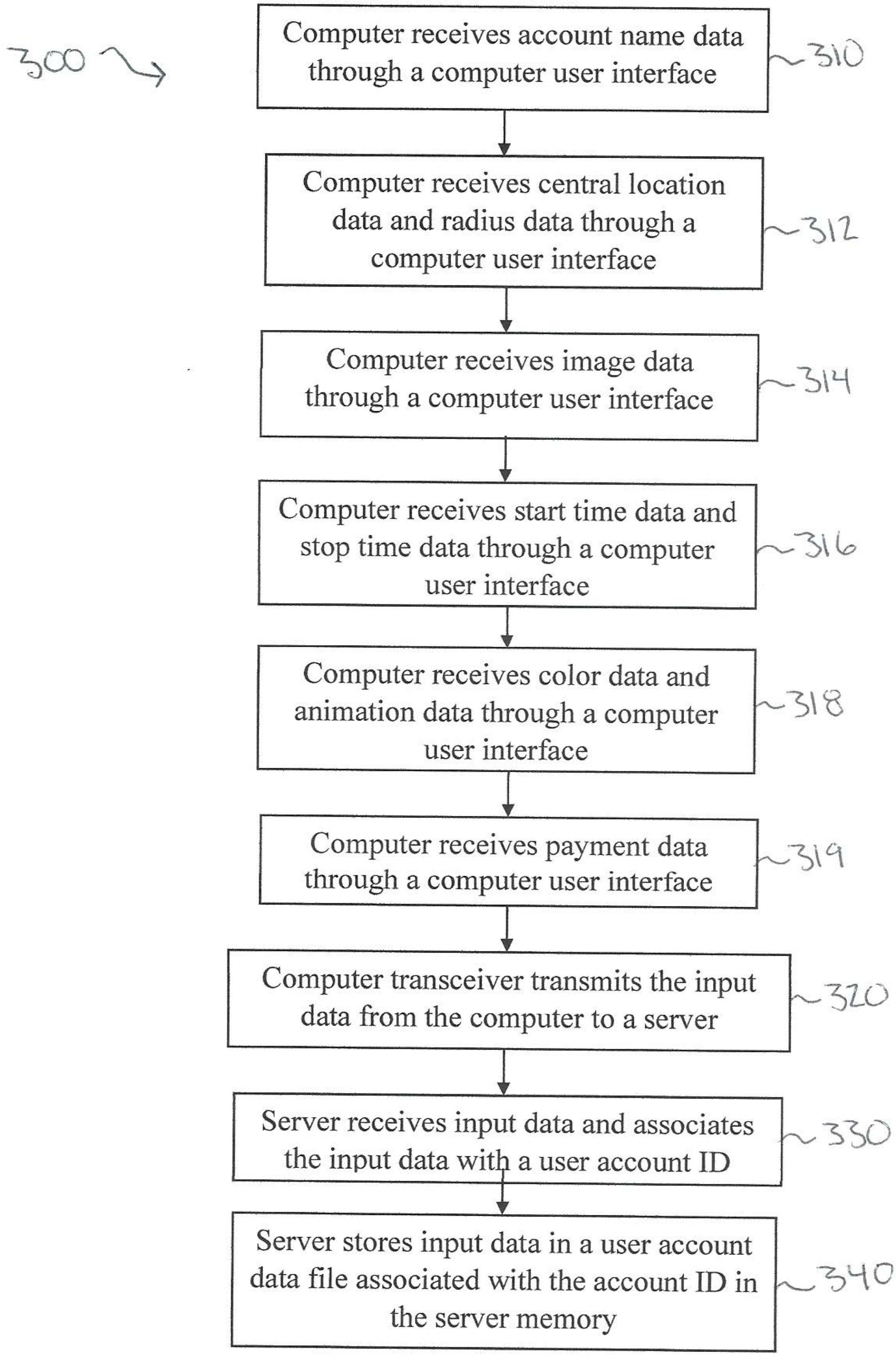

300
Computer receives account name data through a computer user interface
310
Computer receives central location data and radius data through a computer user interface
312
Computer receives image data through a computer user interface
314
Computer receives start time data and stop time data through a computer user interface
316
Computer receives color data and animation data through a computer user interface
318
Computer receives payment data through a computer user interface
319
Computer transceiver transmits the input data from the computer to a server
320
Server receives input data and associates the input data with a user account ID
330
Server stores input data in a user account data file associated with the account ID in the server memory
340

Figure 4

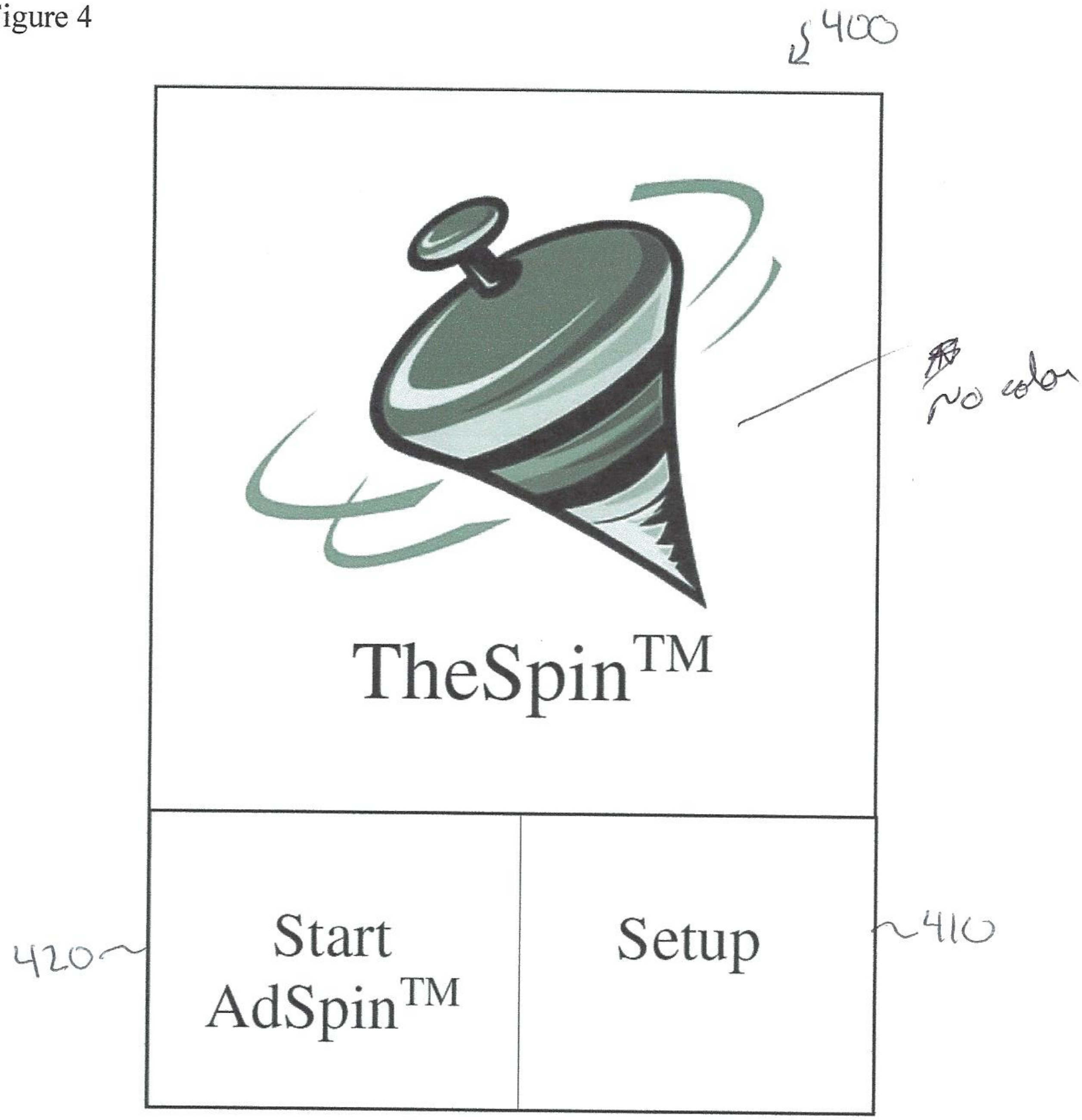


Figure 5

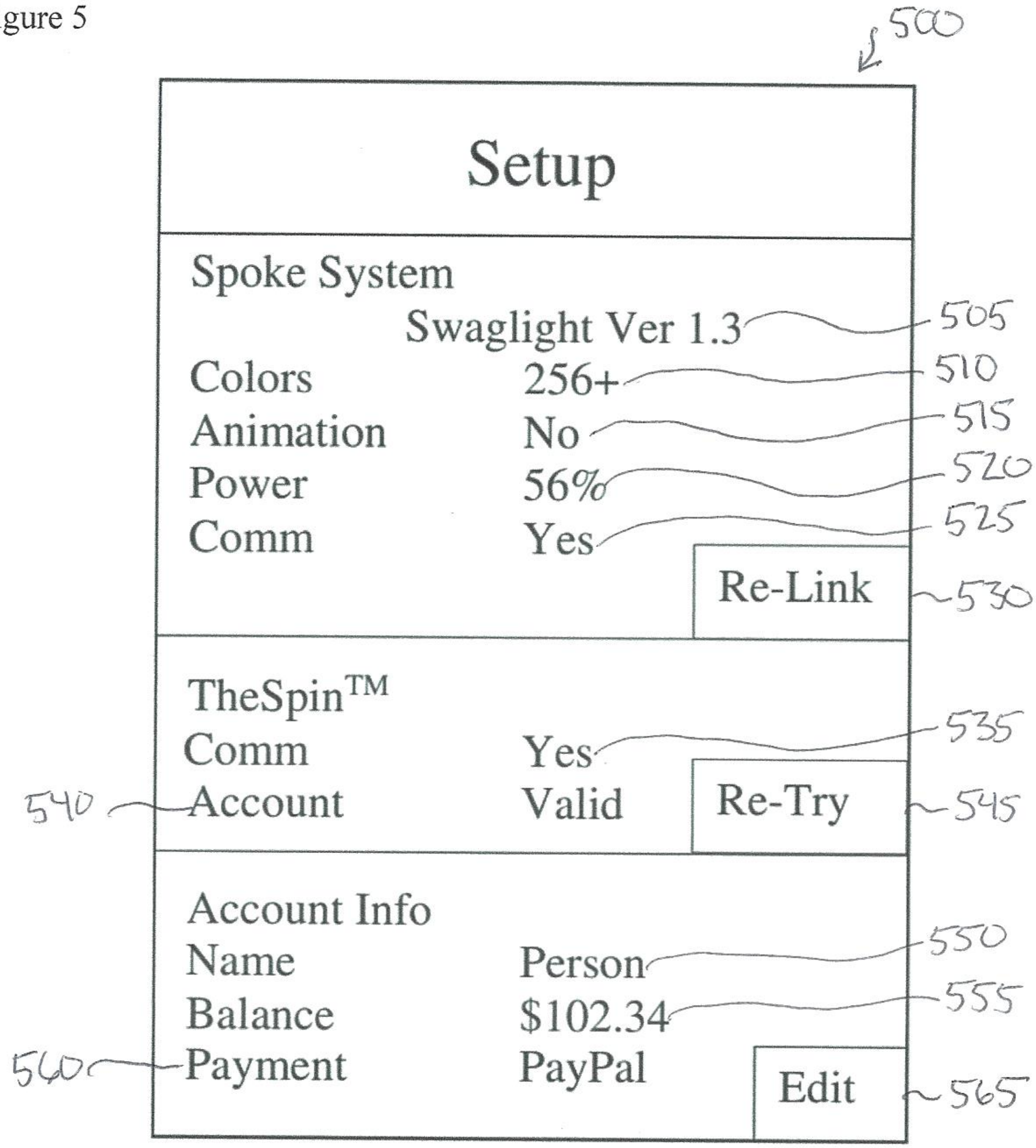

500
Setup
Spoke System
Swaglight Ver 1.3
505
Colors 256+
510
Animation No
515
Power 56%
520
Comm Yes
525
Re-Link
530
TheSpin™
Comm Yes
535
540
Account Valid
Re-Try
545
Account Info
Name Person
550
Balance $102.34
555
560
Payment PayPal
Edit
565

Figure 6

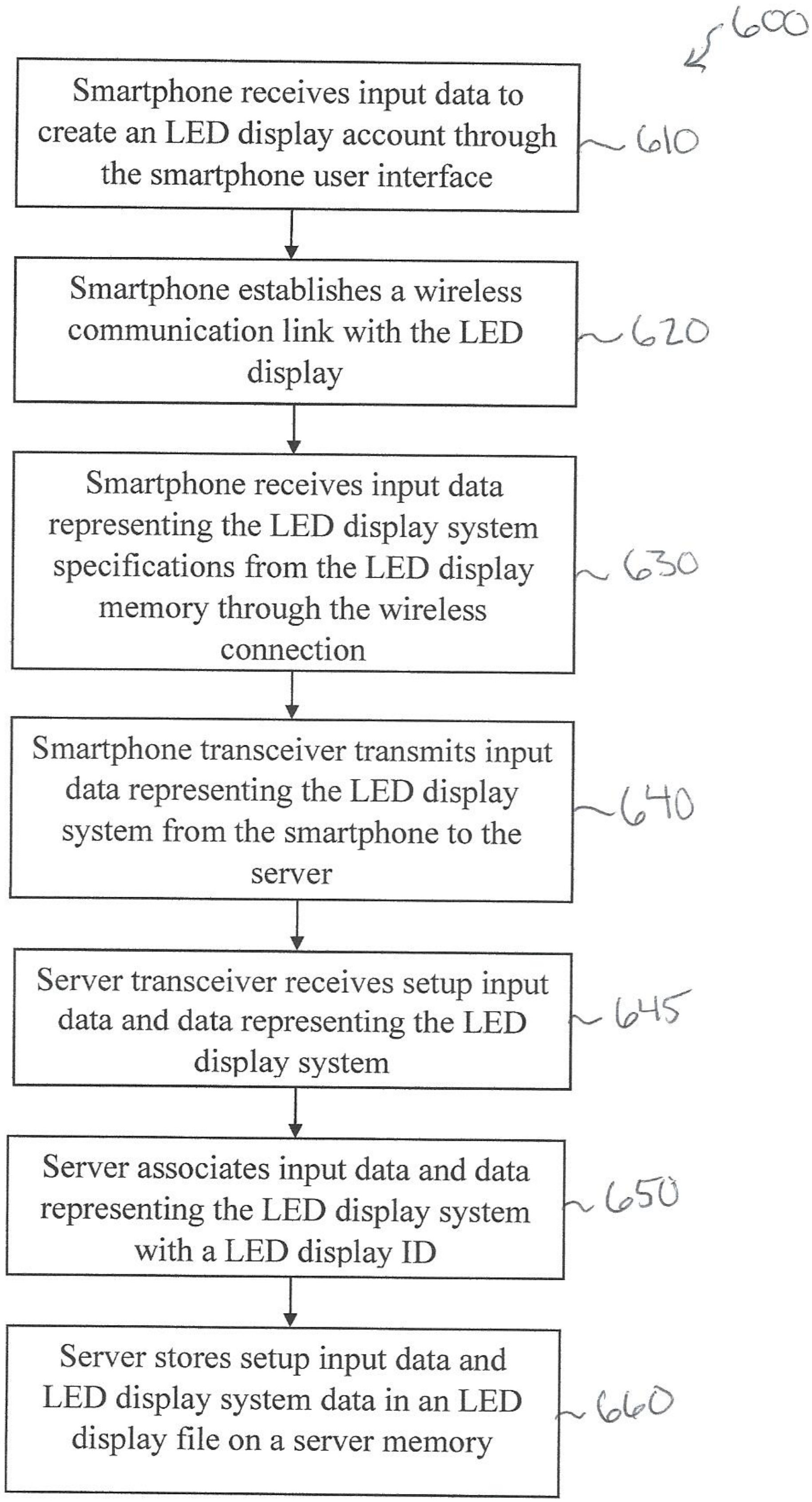

600
Smartphone receives input data to create an LED display account through the smartphone user interface
610
Smartphone establishes a wireless communication link with the LED display
620
Smartphone receives input data representing the LED display system specifications from the LED display memory through the wireless connection
630
Smartphone transceiver transmits input data representing the LED display system from the smartphone to the server
640
Server transceiver receives setup input data and data representing the LED display system
645
Server associates input data and data representing the LED display system with a LED display ID
650
Server stores setup input data and LED display system data in an LED display file on a server memory
660

Figure 7

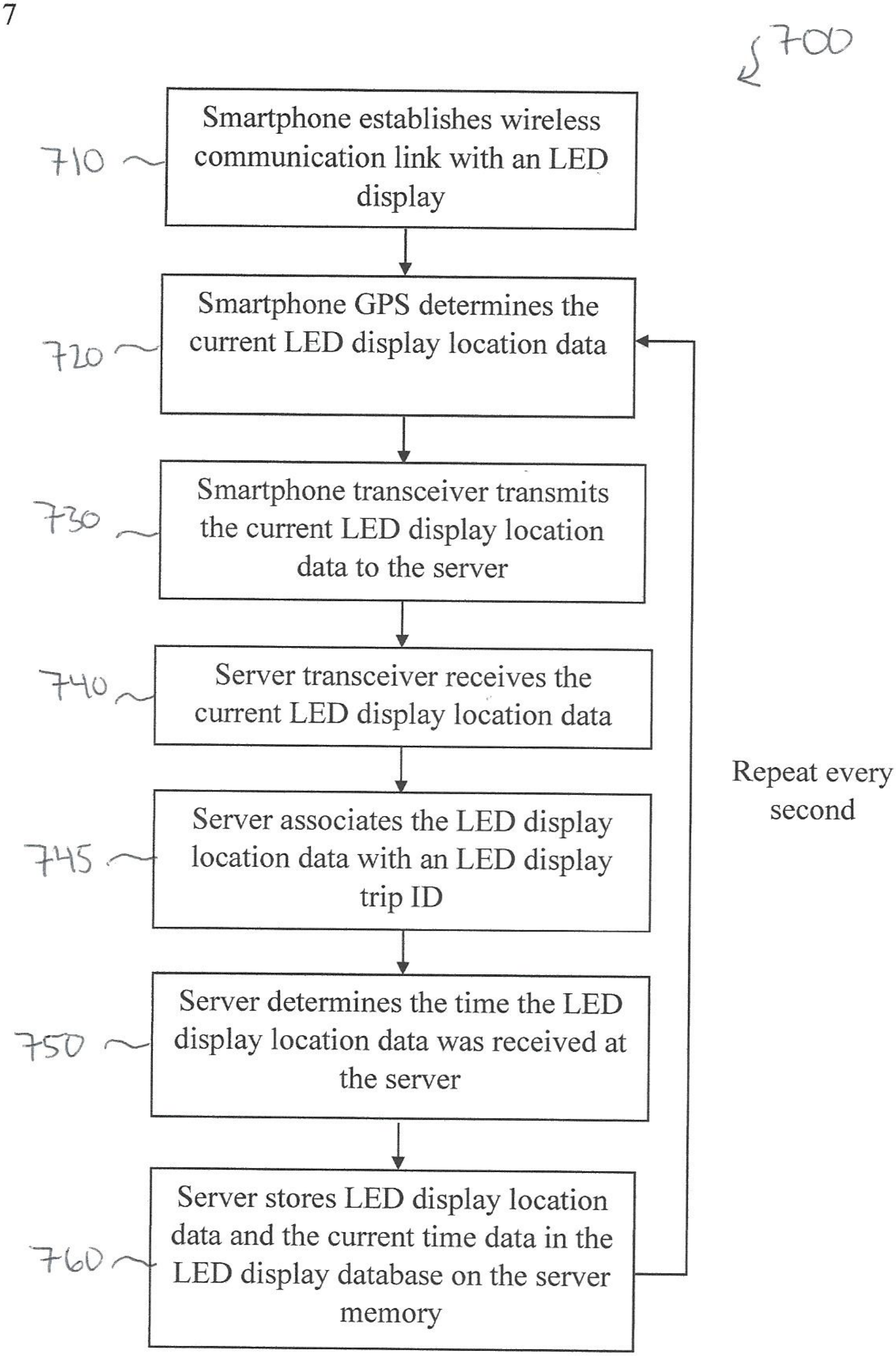

700
710
Smartphone establishes wireless communication link with an LED display
720
Smartphone GPS determines the current LED display location data
730
Smartphone transceiver transmits the current LED display location data to the server
740
Server transceiver receives the current LED display location data
745
Server associates the LED display location data with an LED display trip ID
750
Server determines the time the LED display location data was received at the server
760
Server stores LED display location data and the current time data in the LED display database on the server memory
Repeat every second

Figure 8A Can't do this for method steps – only structural elements – My bad, I should have told you

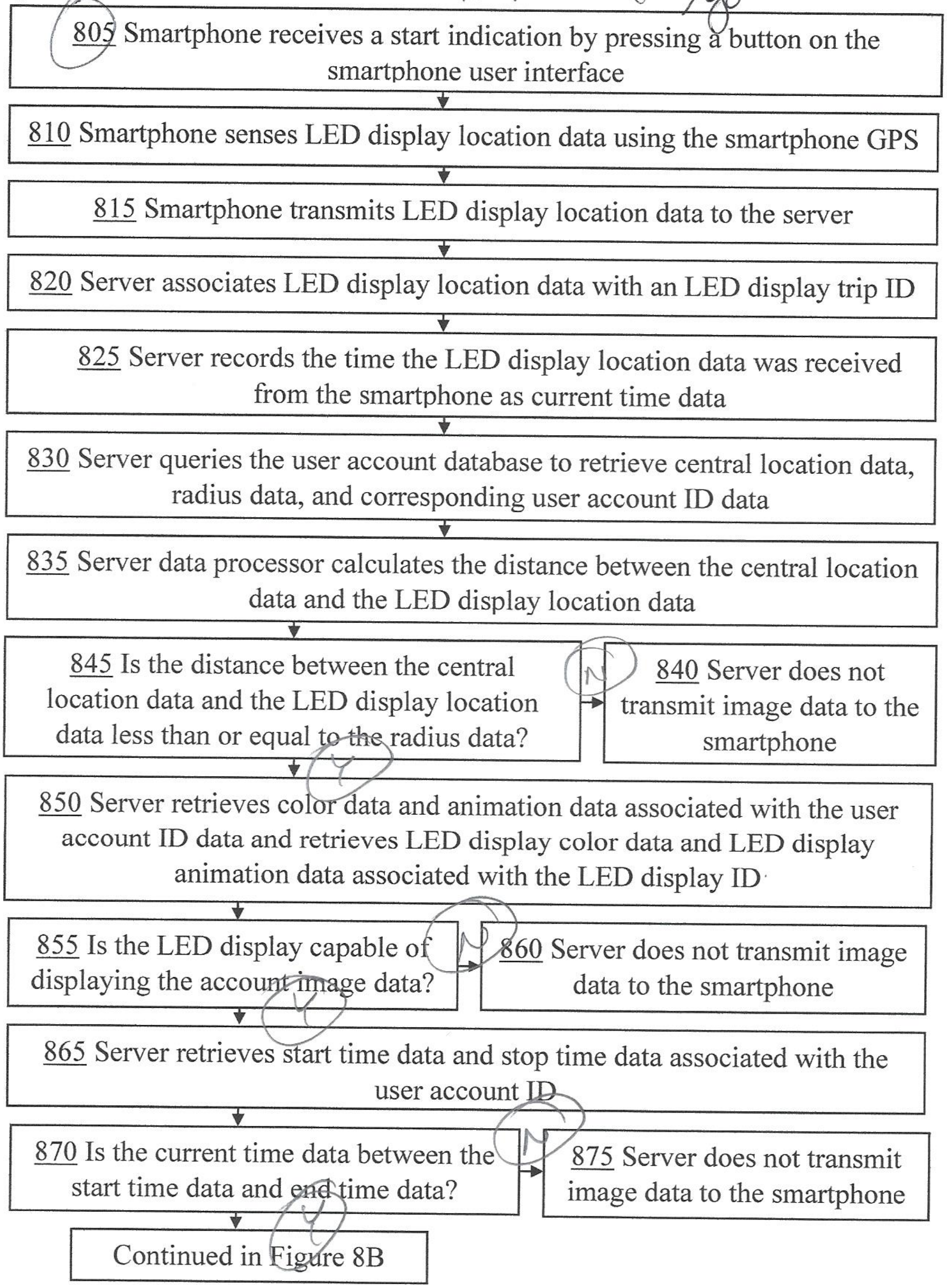


Figure 8B

Continued from Figure 8A

↓

880 Server retrieves image data associated with the user account ID data from the user account database in the server memory

↓

885 Server transmits image data associated user account ID data to the smartphone over a network connection

↓

890 Smartphone establishes a wireless communication link with an LED display using a wireless transceiver

↓

895 Smartphone transmits image data to the LED display through the wireless communication link

↓

897 LED display activates LED light bank in response to the image data

↓

899 Smartphone receives a stop indication by pressing a button on the smartphone user interface

Figure 9

905 Server transceiver transmits image data to an LED display

↓

910 Server determines (1) the user account ID data associated with the image data and (2) the LED display trip ID associated with the LED display trip

↓

915 Server queries the server memory based on the user account ID data to retrieve the max ad price data and the total ad budget data from the user account database

↓

920 Server subtracts the max ad price data from the total ad budget data

↓

925 Server saves the updated total ad budget data in the user account database

↓

930 Server queries the server memory based on the LED display trip ID data to retrieve the total amount earned data and total ad count data

↓

935 Server adds 1 to the total ad count data

↓

940 Server saves the updated total ad count data in the LED display trip database

↓

945 Server adds the max ad price data to the total amount earned data

↓

950 Server saves the updated total amount earned data in the LED display trip database

Figure 10

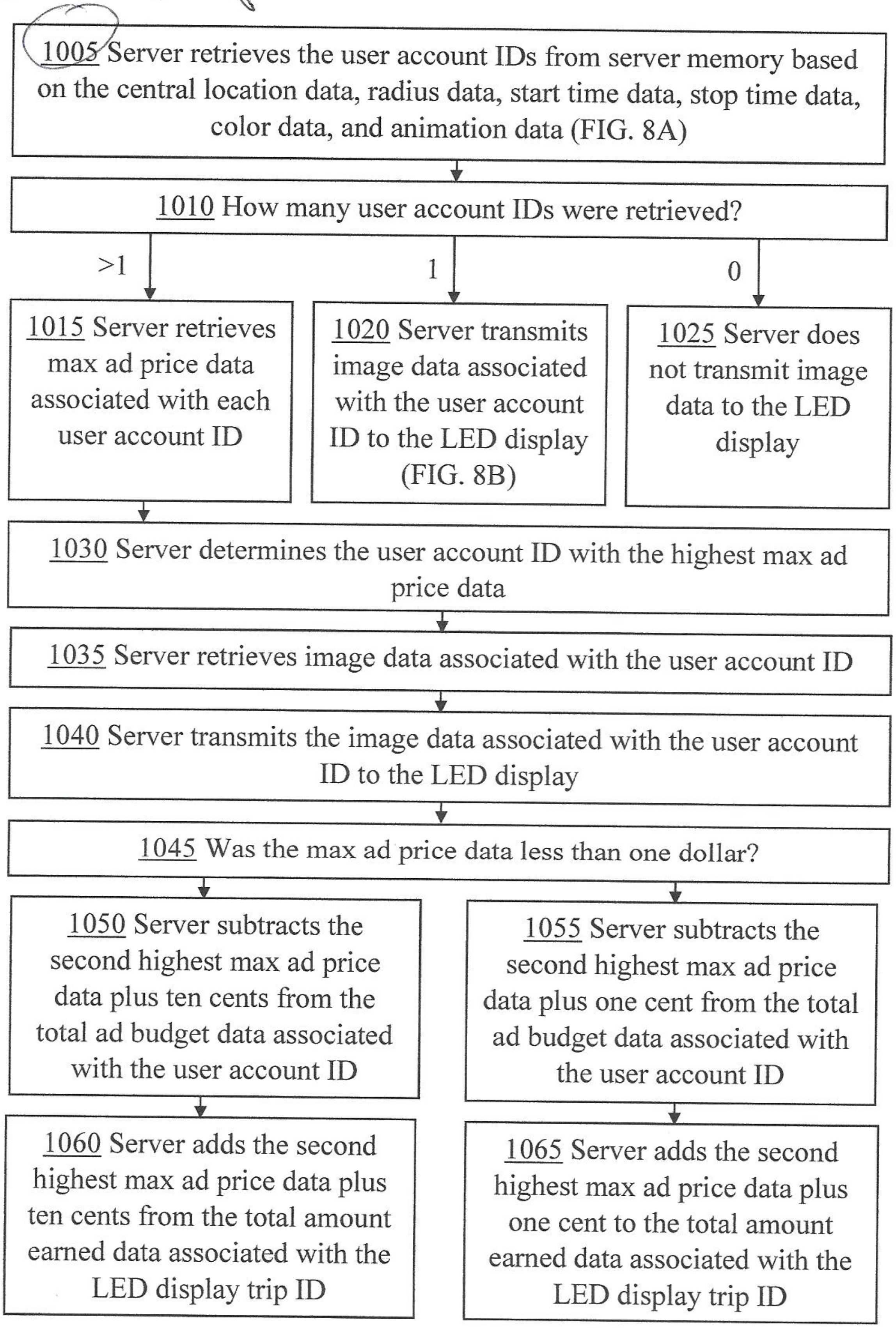

1005 Server retrieves the user account IDs from server memory based on the central location data, radius data, start time data, stop time data, color data, and animation data (FIG. 8A)
1010 How many user account IDs were retrieved?
>1
1
0
1015 Server retrieves max ad price data associated with each user account ID
1020 Server transmits image data associated with the user account ID to the LED display (FIG. 8B)
1025 Server does not transmit image data to the LED display
1030 Server determines the user account ID with the highest max ad price data
1035 Server retrieves image data associated with the user account ID
1040 Server transmits the image data associated with the user account ID to the LED display
1045 Was the max ad price data less than one dollar?
1050 Server subtracts the second highest max ad price data plus ten cents from the total ad budget data associated with the user account ID
1055 Server subtracts the second highest max ad price data plus one cent from the total ad budget data associated with the user account ID
1060 Server adds the second highest max ad price data plus ten cents from the total amount earned data associated with the LED display trip ID
1065 Server adds the second highest max ad price data plus one cent to the total amount earned data associated with the LED display trip ID

Figure 11

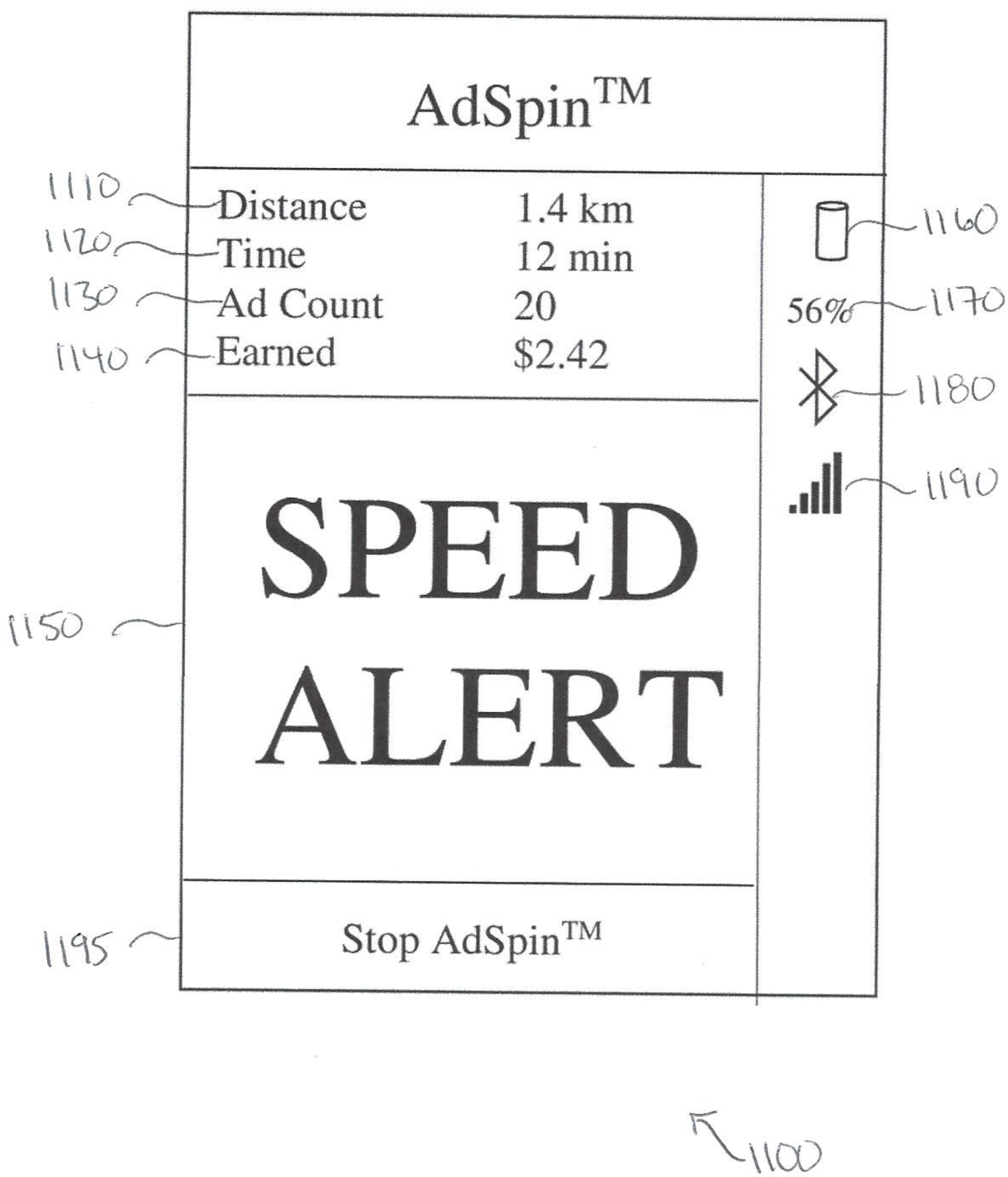

AdSpinTM
1110
Distance
1.4 km
1120
Time
12 min
1130
Ad Count
20
1140
Earned
$2.42
1160
56%
1170
1180
1190
SPEED
ALERT
1150
1195
Stop AdSpinTM
1100

Figure 12

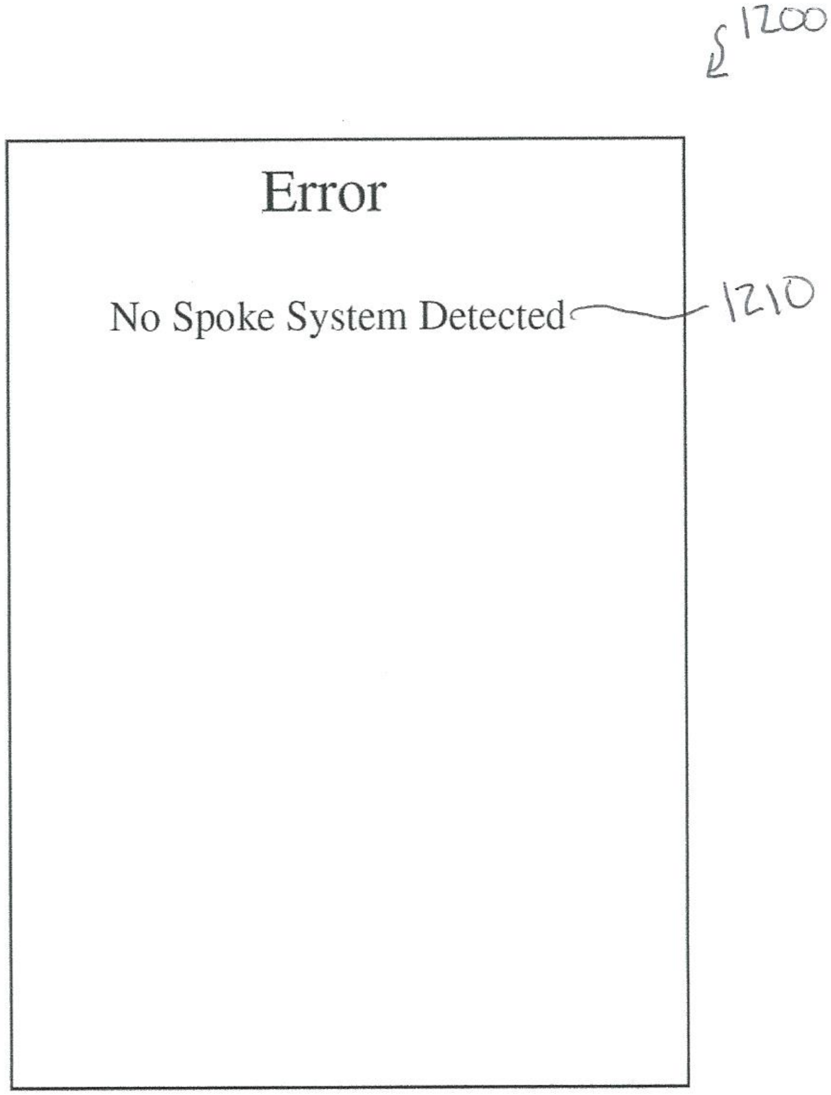
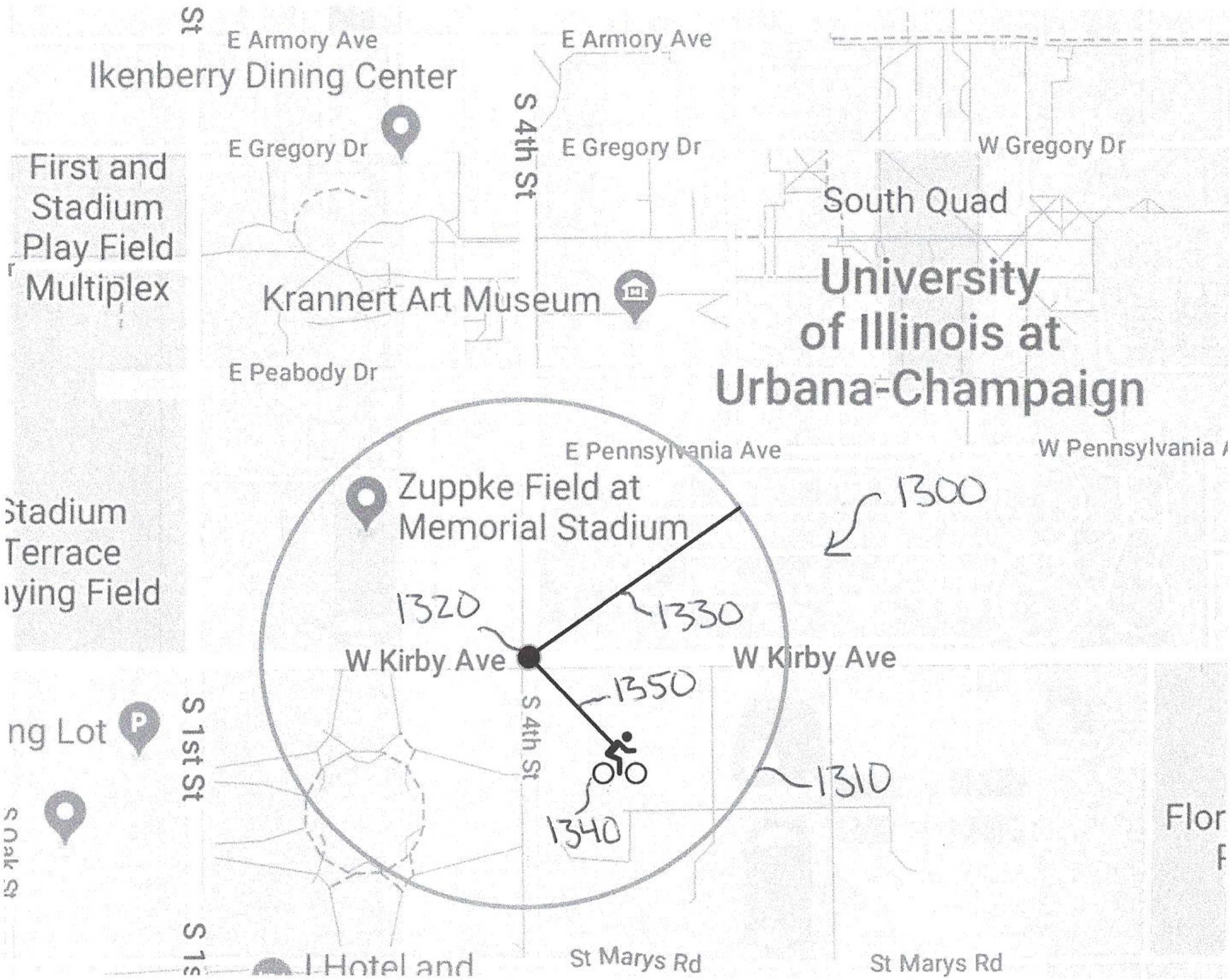


Figure 13



E Armory Ave
Ikenberry Dining Center
E Armory Ave
S 4th St
E Gregory Dr
E Gregory Dr
W Gregory Dr
First and Stadium Play Field Multiplex
South Quad
University of Illinois at Urbana-Champaign
Krannert Art Museum
E Peabody Dr
E Pennsylvania Ave
W Pennsylvania
Zuppke Field at Memorial Stadium
1300
1320
1330
W Kirby Ave
W Kirby Ave
1350
S 4th St
S 1st St
1310
1340
St Marys Rd
St Marys Rd