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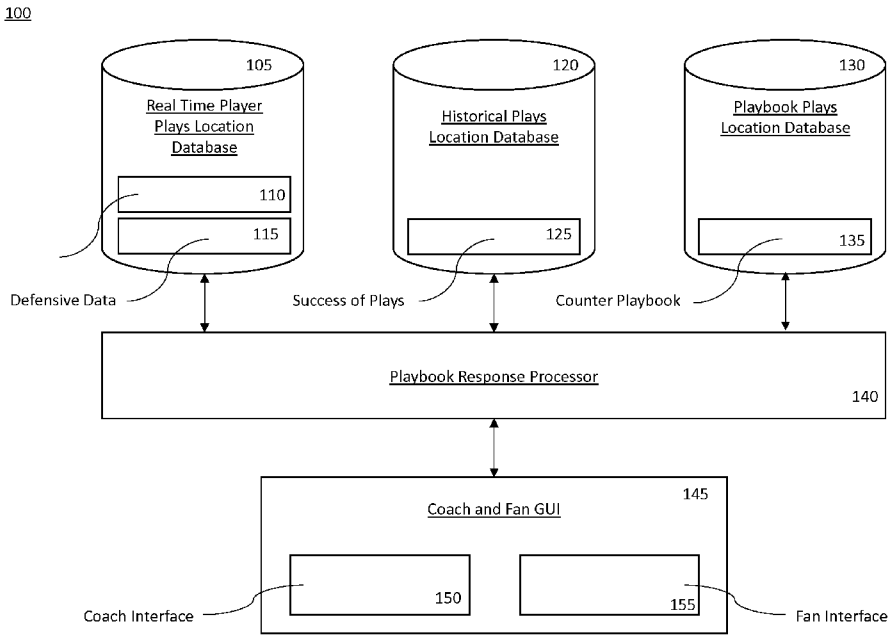

FIG. 1

(57) Abstract: Systems and methods for identifying recorded playbook plays are described. The method includes recording locations of one or more players during execution of a play and evaluating the recorded locations with one or more known plays in a playbook. Based on the evaluation, one or more plays can be identified as being most correlated with the recently executed play. The evaluation can also be used to compare how a particular player has been executing the playbook play (e.g., deviations). Use of the identified play can also be used to produce one or more counter-plays.

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PLAYBOOK PROCESSOR

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims the priority benefit of U.S. provisional application number 62/023,348 filed July 11, 2014 and entitled "Playbook Processor" and U.S. provisional application number 62/023,377 filed July 11, 2014 and entitled "Playbook Response Processor," the disclosures of which are incorporated herein by reference.

BACKGROUND OF THE INVENTION

Field of Invention

[0002] The present invention generally relates to collecting sports data. More specifically, the present invention relates to a playbook processor.

Description of the Related Art

[0003] Collection of sports data has been performed (*e.g.*, U.S. Patent 8,289,185) through the use of one or more sensors mounted, affixed, or embedded on at least one sports participant (*i.e.*, a player playing in a sporting event). The sports data may include identification of the sports participant as well as corresponding movement, position or condition of the sports participant during the sporting event. This sports data can be collected, processed and rebroadcasted to one or more viewers (*e.g.*, coaches, medical professionals, general public/fans) for a variety of different uses. For example, the sports data may be used to monitor the health condition of the sports participants.

[0004] Another use of the sports data may include displaying the location of every player on the playing field of the sporting event. The location of each player may be displayed on a virtual display replicating the current state of the game that can further be used by commentators, coaches and fans to view real-time video of the sports participants and see the actions of the players with respect to the playing field (*i.e.*, a play from the playbook).

[0005] There is no current available way for a user (*e.g.*, opposing coach, fan) to know in real time what play from a playbook will be executed from each respective team (*i.e.*, offense, defense) before the play is carried out. Furthermore, there is no current way to evaluate how well each sports participant is executing a particular play or how well the particular play is being performed overall.

SUMMARY OF THE CLAIMED INVENTION

[0006] A method for identifying a recorded playbook play is described. The method includes obtaining a starting location of one or more players on a team. During execution of a play, successive locations for the one or more players are recorded at regular intervals. By evaluating the recorded execution of the play with one or more known plays in a playbook, a playbook processor can identify one or more corresponding plays in the playbook that correspond to the recently executed play. The identified one or more possible plays from the playbook can then be displayed on a user interface for a user to view.

[0007] A system for identifying a recorded playbook play is described. The system includes a user interface and a playbook processor. The playbook processor obtains a starting location of one or more players on a team. During execution of a play, successive locations for the one or more players are recorded at regular intervals. By evaluating the recorded execution of the play with one or more known plays in a playbook, a playbook processor can identify one or more corresponding plays in the playbook that correspond to the recently executed play. The identified one or more possible plays from the playbook can then be displayed on the user interface for a user to view.

[0008] A method for identifying a counter offensive play based on a detected defensive play is described. The method includes obtaining starting locations of the players on the offense and defense. By recording shifts in the defense, a playbook processor can evaluate the recorded shifts with known defensive plays in a playbook. The playbook processor can identify one or more possible defensive play corresponding to the recorded shifts. In situations where the current play has a low success rate, the playbook processor can identify one or more counter-plays that can be used whereby the counter-plays have a higher success rate against the detected defensive play. The information from the playbook processor can be displayed on a user interface for a user to view.

[0009] A system for identifying a counter offensive play based on a detected defensive play is described. The system includes a user interface and a playbook

processor. The playbook processor obtains starting locations of the players on the offense and defense teams. By recording shifts in the defense, a playbook processor can evaluate the recorded shifts with known defensive plays in a playbook. The playbook processor can identify one or more possible defensive play corresponding to the recorded shifts. In situations where the current play has a low success rate, the playbook processor can identify one or more counter-plays that can be used whereby the counter-plays have a higher success rate against the detected defensive play. The information from the playbook processor can be displayed on a user interface for a user to view

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIGURE 1 illustrates a system for processing playbook plays.

[0011] FIGURE 2 illustrates an implementation of the system for monitoring offensive plays for one team.

[0012] FIGURE 3 illustrates an evaluation of one particular player during an offensive play.

[0013] FIGURE 4 illustrates a flowchart for the playbook processor for evaluating offensive plays.

[0014] FIGURE 5 illustrates the coach and fan GUI for displaying evaluations of the offensive play.

[0015] FIGURE 6 illustrates an implementation of the system for monitoring defensive plays for one team.

[0016] FIGURE 7 illustrates a further detailed monitoring of one particular player during a defensive shift.

[0017] FIGURE 8 illustrates the coach and fan GUI for simultaneously displaying offensive and defensive play data.

[0018] FIGURE 9 illustrates a flowchart for the playbook processor for determining a counter play based on an observed defensive play.

DETAILED DESCRIPTION

[0019] The systems and methods described herein are directed towards providing information regarding potential plays from a playbook. More specifically, by utilizing the ability to track sports data of each sports participant (or player) on the playing field (*e.g.*, geolocation), the systems and methods described herein can predict what plays may be executed, how well each player is executing the play and information pertaining to the execution of the play (*e.g.*, number of attempts, average number of yards).

[0020] The information regarding plays from a playbook can be provided to a variety of different parties of interest. Coaches may find this information beneficial to evaluate how well their respective teams are executing a given play and determine when the play should be used. The coaches may also use this information to observe and predict what plays the opposing team could possibly execute. Fans could use this information to further immerse their viewing experience when viewing the sporting event.

[0021] It should be noted that the embodiments described herein when describing the present invention are directed towards the sport of American football. The embodiments, however, are not solely limited to American football. Other sports, such as basketball, soccer and hockey may also utilize the present invention in order to provide users the ability to monitor the location of each of the players playing the game and evaluate performance of the plays executed by the players.

[0022] FIGURE 1 illustrates a system 100 for processing playbook plays. The system 100. The system 100 includes a variety of different elements including databases used to store obtained sports data related to the players (*e.g.*, geolocation) 105, plays from one or more playbooks 130, and information about the executed plays from the one or more playbooks 120. The system 100 also includes a processor 140 for processing the information from the three databases 105, 120, 130 so that the user (*e.g.*, coach, fan) can view the information on a graphical user interface (GUI) 145. Further details pertaining to the different elements of the system 100 is provided below.

[0023] With respect to the real-time player plays location database 105, this database houses sports data obtained for each player. Exemplary sports data obtained from each player may include their location (*e.g.*, geolocation). Such sports data may be obtained from one or more sensor associated with each player. The sensors may be mounted, affixed or embedded on each player (*e.g.* jersey, helmet, padding). Sensors may also be placed on the football for the purposes of obtaining the location of the football in real time. In this way, sports data relating to the position of every player on the field as well as the location of the ball can be collected and used.

[0024] The information stored in the real-time player plays location database 105 may be separated into various sub-groups. For example, the real-time player plays location database 105 may separate data between the different teams playing in the particular sporting event. The database 105 may also separate each group of data of each team between their data concerning their offense (*e.g.*, offensive data 110) and their defense (*e.g.*, defensive data 115). Such separation of the sets of data between teams may prove beneficial since each team may have their own respective playbooks having distinct plays. Furthermore, separation between offensive data and defensive data for each team may prove beneficial as well since the plays associated during the offensive phase and the defensive phase for a particular team are distinct as well.

[0025] The historical plays location database 120 stores all the measured sports data for one or more plays that have been executed. The historical plays location database 120 may organize the data based on individual plays. The sports data associated with each executed play may include information, for example, describing the success of the play 125. Exemplary information used for evaluating success 125 of a particular play may include how many times a particular play was run and on average how much yardage was gained or lost each time the play was executed.

[0026] The playbook plays location database 130 stores the theoretical plays that one or more teams can utilize. The information stored in the database 130 would include the details of how a play is executed. More specifically, for each player, instructions of how to run the play (*i.e.*, where the player sets up and where the play moves to) are provided. The plays stored in the playbook plays location database 130

may include plays that were previously drawn out using graphics or drawn out on paper so that any one player would know his location on the field and his role. The information now previously provided visually using graphics or paper is stored in the database 130.

[0027] The playbook plays location database 130 may include the playbook for one or more teams. In situations where the playbook plays location database 130 includes plays of the two teams participating in the same game, a counter playbook 135 may also be available. The counter playbook 135 may be used by users of one team (*e.g.*, players, coaches) to determine what play could be used to better success based on the predicted play the opposing team is planning on using. The counter play from the counter playbook 135 can be used to identify a different play to run based on, for example, on how the opposing players are situated prior to the execution of the original play.

[0028] The playbook processor 140 is software that looks at information from the real-time player plays location database 105, historical offensive and defensive plays location database 120 and the playbook plays location database 130 to provide corresponding information requested by the user. For example, the playbook processor can provide the user with the best play from the playbook to be used, historical data about that chosen play and how well each of the players generally execute the chosen play. In some embodiments, the playbook processor 140 can evaluate how the opposing team is situated in order to provide a counter play that can be used. The counter play could be a different play than what was originally chosen aimed at providing a more successful result by, for example, catching the opposing team off guard. In one such situation, the counter play may advise that a throw-based play could be more successful based on how the defense is lined anticipating a possible run-based play. The playbook processor 140 would be capable of evaluating the location of each player on both teams (*e.g.*, offense and defense) and provide for each side an ideal play to run for that moment in time.

[0029] The information from the playbook response processor 140 is then provided to the GUI 145 which allows users to view a variety of information that can be requested. Depending on the user (*e.g.*, fan, coach), different types of information can be provided through the use of different types of interfaces. Although the

coaches, players and fans may be capable of accessing the same information, it may be desired to provide coaches and players with additional information (*e.g.*, personal biometric information of the players) that fans would not be capable of obtaining.

[0030] FIGURE 2 illustrates an implementation of the system for monitoring offensive plays for one team. More specifically multiple real-time images/diagrams of the offensive team have been captured showing positions of the players and the football at a particular point in time. The positions of each of the players are also indicated in the diagram. It may also be possible to identify the players via their player number or name (*i.e.* last name).

[0031] With reference to FIGURE 2, the figure illustrates three conceptual diagrams/real-time images illustrating the offensive team on the football field at three different periods of time denoted as T0, T1 and T2. The three conceptual diagrams are all focused around the line of scrimmage where an offensive play will generally be initiated. With reference to the different time periods captured, T0 may correspond to a time before the snap, T1 may correspond to a time shortly after the snap (*i.e.* after the offensive play has been initiated) and T2 may correspond to a different period of time after the snap (*i.e.* after the offensive play has been executed).

[0032] With reference to the diagrams, lines may be used to illustrate the path of each of the players and/or the ball. For example, dotted lines can be used to illustrate the path where a particular player moved on the field compared to their starting position denoted in T0 (as illustrated in T1). Additionally, a solid line can be used to illustrate the direction the football was thrown by the quarterback (as illustrated in T2).

[0033] It should be noted that additional time periods may also be captured and monitored. With the use of more time periods, an offensive play can be broken into more segments that can be monitored thereby providing a more detailed progression of how an offensive play is executed.

[0034] It should be noted, at least in FIGURE 2, only the offensive team along with the position of the football has been included in the diagrams/real-time images. In other embodiments, inclusion of the defensive team can also be implemented. Along with the movement of the offensive players, information about how the defensive team responded can also be included. In this way, the monitoring of how

the defensive play is executed based on the executed offensive play can also be performed.

[0035] FIGURE 3 illustrates an evaluation of one particular player during an offensive play. More specifically, FIGURE 3A monitors the position of the player during different time periods (*i.e.* T0, T1, T2, T3). Meanwhile, FIGURES 3B-3D evaluates the position of the player executing a particular play and compares it with past execution of the play and/or the theoretical actual play that the player should have executed. It should be noted that other embodiments may illustrate more than one player at a time executing a play. These situations may arise when two or more players may need to operate in tandem to execute a play (*e.g.*, one player executes a screen for another player).

[0036] With reference to FIGURE 3A, one player (identified as '1') is being evaluated during execution of play #151. The figure includes snapshots of the position of the player during execution of the play at four different times where T0 may be prior to the snap at the line of scrimmage while T1, T2 and T3 are later times at regular intervals from each other (*e.g.*, 5 seconds, 10 seconds, 15 seconds after the snap). A dotted line may be used to illustrate a general path the player may have taken while traveling from one point to another. It should be noted that the play (*e.g.*, play #151) can be one of many plays that a team can execute during the game.

[0037] With reference to FIGURE 3D, an exemplary play is shown with reference to the same play. In particular, the exemplary play may correspond with the actual play that the coach intended that the particular player run. To denote the actual execution of the desired play, the figure may include a solid line (as opposed to a dotted line as illustrated in FIGURE 3A) where the solid line indicates an actual path that the player should have moved along in order to properly execute the play as planned.

[0038] Aside from the illustration of the theoretical play that should be executed by the player as seen in FIGURE 3D, information regarding the play (*e.g.*, the curve and the x, y coordinates corresponding to the path) describing how the play should be executed by one or more players is also stored (*e.g.*, playbook plays location database) and is referenced by the playbook processor when later evaluating how well the player executed the play.

[0039] With reference to FIGURE 3C, an illustration combining the theoretical play that would be executed by a particular player (as shown in FIGURE 3D) with one or more past executions of the same play by the player is shown. In particular, three past executions of the play (labeled as H1, H2 and H7) have been included in the figure (illustrated via dotted lines) have been included with the theoretical play as illustrated in FIGURE 3D (illustrated with a solid line). The lines indicate the path by which the player would move along. With use of FIGURE 3C, one would be capable of evaluating how well the player has been executing the actual play by comparing the historical paths (dotted lines) with the actual play (solid line).

[0040] With reference to FIGURE 3B, the most current attempt (as illustrated in FIGURE 3A) has also been included along with the historical data and the actual play to be executed. A comparison of the most current attempt can be made alongside the historical attempts (illustrated via dotted lines) and the theoretical actual play (illustrated with a solid line). This comparison can be used to evaluate how well the player has been executing the play.

[0041] In another embodiment, as described below, the curves for one or more players corresponding to the most current execution of a play can be used by the playbook processor to identify potentially what play was just executed by the team. The playbook processor can compare the most recent data (*e.g.*, most current execution of a play) of one or more players with data of the actual plays stored, for example, in the playbook plays location database in order to guess what play was actually run.

[0042] FIGURE 4 illustrates a flowchart 400 for the playbook processor for evaluating offensive plays. More specifically, the flowchart performs a number of steps in monitoring and evaluating the executed plays of one or more players in order to determine what play was most recently run.

[0043] In step 405, the playbook processor obtains an initial position of one or more players. The initial position may correspond with a set position that the one or more players are assigned to before executing the play. For example, the players may be assigned a particular position at the line of scrimmage prior to the snap (*i.e.* indication that the play is being executed). The initial position may correspond with the label T0 (as illustrated, for example, in FIGURE 3A and 3B).

[0044] In step 410, the playbook processor performs and evaluation as to whether the current positions of one or more players correspond to the initial positions (*i.e.* rest/reset position). There may be situations where one or more players shift or re-adjust their position prior to the snap. If a readjustment is performed by one or more players, the playbook processor can record the new initial position (via step 405). Otherwise, the playbook processor can proceed with recording the execution of the play by one or more players.

[0045] In step 415, once the play has begun (*i.e.* after the snap), each of the positions of one or more players is recorded at regular intervals (*i.e.* T1, T2, T3). As noted above, T0 corresponds with the initial position prior to the snap while T1, T2, T3 and so one may correspond with positions in time after the snap. The interval chosen for the recorded position may be customized based on the detail of each position of the players as desired. For example, with smaller intervals in time, more details may be obtained regarding the various movements a particular player may have used to get from one point to another. Overall, more details may provide a smoother transition between the initial position and the end position.

[0046] With the data obtained in step 415, the playbook processor can evaluate one or more positions of a corresponding player to determine what play from the playbook was just run by that player (*i.e.* step 420). Evaluation of what was run by the player and what is a theoretical play that may have been run by the player is performed by comparing information about the path of the play. Therefore, the playbook processor compares, for example, x and y directional components of the recently executed play with the x and y directional components of the theoretical play. By looking at the path the player of the recently executed play, the playbook processor can determine which one or more plays most correlated to the recently obtained data (*i.e.* step 425).

[0047] There may be situations where analyzing a single player execution of a play may bring up multiple possible plays. For example, there may be two or more plays that may have a particular player run the same pattern. In any case, each of the possible plays that closely corresponds to what was run by that play can be saved in memory associated with that particular player (*i.e.* step 430).

[0048] In order to better determine what play was run by the offensive team, steps 420, 425 and 430 can be performed with each and every player on the offensive team for which movement data was obtained. Even though one or more players may run a similar pattern in multiple plays, each play should have a distinct difference differentiating one play from another. By analyzing all the players on the offensive plays, the playbook processor can obtain a list of possible plays corresponding to what each respective player could have possibly ran. Each list of possible plays is associated with each player (*i.e.* step 430).

[0049] The best fit (or most probable play that was just executed by the offensive team) can then correspond to the possible play that appears most frequently in the majority of the list of possible plays associated with each player (*i.e.* step 440). The playbook processor can evaluate each of the list of possible plays for each player. Based on the best fit (or most probable play ran by the respective player), the playbook processor can determine which theoretical play appears the most in all the players. The determination can be used to indicate what play was most likely just executed by the offensive team.

[0050] In another embodiment, the best fit may be based on a threshold value corresponding to the correlation between the path ran by each player during the executed play and the paths for the players during the theoretical play. The threshold value may be customizable and set by the user. The threshold value may, for example, allow for some deviation from a play in the playbook without affecting the identification of the path with a particular play. Given the leeway that the threshold value may provide, more than one best fit may be possible.

[0051] FIGURE 5 illustrates the coach and fan GUI for displaying evaluations of the offensive play. The coach and fan GUI may provide one or more windows used to provide information that the playbook processor collected and processed regarding execution of a play by one or more players. For example, the coach and fan GUI may include windows A-D as illustrated in FIGURE 5. Window A illustrates a real-time viewer. Window B illustrates a playbook viewer. Window C illustrates a historical viewer. Window D illustrates a playbook comparison. Further details regarding the exemplary windows A-D are provided below.

[0052] With reference to window A, an actual recording of one or more players can be viewed. The recording may be directed towards a real-time image/video capture of one or more players executing a play from the playbook. In an embodiment, the coach and fan GUI may be touch screen thereby allowing the user to interact with controls used to manipulate the real-time recording of the executed play. For example, a user may be capable of fast forwarding, rewinding, or pausing the recording of a particular play. The user may also be capable of jumping forward or backwards in time corresponding to particular time segments (*i.e.* T1, T2, T3).

[0053] With reference to window B, the playbook processor can display the "best" theoretical play from the playbook that corresponds with the recently executed play from the one or more players in the football game. The window may also identify the particular play from the playbook (*e.g.*, play #151). Similar to FIGURE 3D, the theoretical play executed by the one or more players may provide a starting position for each of the players along with the path the players are instructed to take during the execution of the play, which is denoted using solid lines.

[0054] By using the play controls, the user may be capable of viewing other players within the team and their corresponding role within the theoretical play. In some cases, by viewing other players (*e.g.*, a subset of players as opposed to the entire team), the playbook processor may be capable of providing the next "best" theoretical play from the playbook that may have been performed by the other players.

[0055] With reference to window C, the playbook processor can combine the theoretical "best" play from the playbook (denoted using solid lines) with one or more historical execution of that same play by the one or more players (denoted using dotted lines). The user viewing the window through the coach and fan GUI can see the variations of the play executed by each of the players against the "best" theoretical play from the playbook.

[0056] With reference to window D, the playbook processor can combine all the information provided in windows A-C in order to evaluate how well a particular player executed the play being viewed. The playbook processor may provide an indication of how well the player executed the play (*i.e.* perfect, poor, average).

[0057] Through the use of the coach and fan GUI, as illustrated in figure 5, a user (*e.g.*, a fan, coach) knows what the theoretical play being run is as well as is capable of comparing the execution of the play by one or more players against the identified theoretical play. This information pertaining to the identified theoretical play and the evaluation of the execution of the play by the players can be provided to the user close to real-time (*e.g.*, right after the play has been executed).

[0058] It should be noted that although embodiments illustrated in the figure only depicts the offensive team and their execution of the play, there may be embodiments may also incorporate the positions and actions of the defensive team as well. The information pertaining to the defensive team may provide further information as to why a particular player deviated from the theoretical play. This information, if used by the playbook processor, may be used to better evaluate performance of a particular player according to the theoretical play from the playbook.

[0059] The embodiments described above are mainly directed towards the offensive team. For example, recording of one or more players can be used to evaluate what play was run and how well a particular player executed the play. This information can be provided to users (*e.g.*, fans and coaches) so that they can better understand what is happening during the football game.

[0060] With reference to the defensive team, similar features as described above can also be applied in order to monitor the actions of one or more players on the defensive team. Some of the features are directed at monitoring and evaluating execution of defensive plays by one or more players on the defensive team. In some embodiments, however, the information pertaining to the defense can also be used by the offensive team to improve performance against the defense by predicting what the defense plans on doing and choosing a corresponding "counter-play" to the chosen defense.

[0061] FIGURE 6 illustrates an implementation of the system for monitoring defensive plays for one or more players on the defensive team. More specifically, the figure monitors how one or more defensive players are lined up at the line of scrimmage based on the starting position for the offensive team.

[0062] FIGURE 6 illustrates both the offensive team (depicted with circles) and the defensive team (depicted with squares) centered on the line of scrimmage. At least with reference to the offensive team, each of the players on the defensive team may be assigned to an initial starting position prior to the start of the play (*i.e.* T0). With reference to the defensive team, the three figures (A, B and C) illustrate exemplary depictions of shifts in the defense by one or more players prior to the start of the play. For example in A, the WS (safety) is depicted as shifting from an initial position associated with T0 (illustrated as a dotted box) to a different position associated with T1 (illustrated as a solid box). A dotted arrow shows the motion between the starting and second position of the WS. Similarly, B and C shows shifts between the initial positions associated with T0 for the FS, RDE and ML.

[0063] The motions/shifts that are performed as illustrated in A, B and C show defensive players (*e.g.*, WS, FS, RDE, ML) shifting around before the snap (*i.e.* beginning of the offensive play). These shifts may have occurred based on how the offensive team initially set up and the respective players adjusting their starting position in order to pair up with who the player may be assigned to cover. At least in FIGURE 6, both T0 and T1 correspond to periods of time prior to the start of the play (*i.e.* snap of the football).

[0064] FIGURE 7 illustrates a further detailed monitoring of one particular player during a defensive shift. Similar to FIGURE 3 where the one or more offensive players were monitored in detail (*i.e.*, recently executed play, theoretical play from the playbook, historical execution of the play and comparison), the present figure provides similar information at least from the perspective of one or more defensive players.

[0065] With reference to FIGURE 7A, a recording of one of the defensive players (*e.g.*, FS) is taken at two different time periods (*i.e.* T0 and T1). The initial position of the defensive player at T0 is depicted with a dotted box and the new position of the defensive player at T1 is depicted with a solid box. A dotted arrow is used to illustrate the direction the defensive player took in order to move from the initial position to the new position.

[0066] As seen in FIGURE 7A, details pertaining to the defensive shift may be taken with respect to the other plays on the defensive team (*e.g.*, ML, LOL). For

example, the shift may be induced in order to compensate for any potential holes in the offense. The inclusion of one or more relevant defensive players may be possible. Furthermore, details pertaining to the axis (*e.g.*, B-B' and C-C') can be used to quantify the defensive shift from the initial position to the new position.

[0067] As seen in FIGURE 7D, there may be a playbook play for the defensive position (*i.e.* FS). In particular, there may be situations where a particular player is instructed to go based on a particular read (*e.g.*, whether the offensive play is a run or a pass). A play for the defensive position may require the player to be in one position if the offensive play is a run and a different position if the offensive play is a pass. The defensive playbook would have one or more plays describing where each of the players on the defense are supposed to go based on the offense.

[0068] With reference to FIGURE 7C, a historical range is provided for one or more defensive players. Similar to the offensive player in FIGURE 3C, even though the defensive player may be instructed to perform a particular defensive shift in responding to the offensive, there may be variations of the play for one or more reasons. FIGURE 7C provides a general area enclosed via a dotted polygon that dictates where the particular defensive player has been known to move to.

[0069] With reference to FIGURE 7B, a prediction of the potential defensive play is displayed alongside the recorded executed defensive shift (as illustrated in FIGURE 7A). The playbook processor may be capable of providing one or more defensive plays from the defensive playbook corresponding to the recorded defensive shift performed by the particular player. A comparison between the actual and predicted defensive shift can be performed by the user from the use of the display of the information (as seen in FIGURE 7B).

[0070] The knowledge of how one or more defensive players shift based on a perceived offensive play chosen by the offense (based on how the offense lines up at the line of scrimmage) can be useful in predicting how the defense will react to the execution of the play. As described below, the knowledge of how the defense shifts (and therefore prepares for a particular offensive play) can also be used to produce one or more "counter-plays" that can be executed. The "counter-plays" may be helpful for the offensive team in choosing one or more alternate offensive plays that can be used based on the new defensive formation (post defensive shift).

[0071] FIGURE 8 illustrates the coach and fan GUI 800 for simultaneously displaying offensive and defensive play data. The information processed by the playbook processor can be displayed on the GUI 800 for viewing by the user (*e.g.*, fan, coach).

[0072] With reference to the coach and fan GUI 800, there may be an interface 810 that allows the user (*e.g.*, coach, fan) to view the defensive shifts by one or more players. For example, the user may be capable of viewing how the defensive player (*e.g.*, FS) recently shifted from an initial position to a secondary position. The user may also be capable of viewing how the FS should have set up and shifted to the secondary position. This information may be similar to the information displayed in FIGURE 7. It should be noted that this information may be viewable by both the coach and fan alike.

[0073] With reference to the remaining features of the coach and fan GUI 800 (*e.g.*, 820-870), these features may include information that only a coach may be authorized to see. In particular, this information may be beneficial to the coach that is responsible for advising/instructing what plays should be run on the offensive team.

[0074] Dictating what information can be seen by the fan versus a coach can be based on the types of information available to the respective user. In situations where the databases are associated with a particular owner (*i.e.* user), a coach may have specialized information that a fan does not have that can be used to provide the information illustrated in elements 820-870. For example, a coach has access to information about their own playbook. Furthermore, the coach may have spent resources obtaining information about the playbook of the opposing team (*e.g.*, viewing past game footage, scouting). These types of information can be inputted by the coach so that the playbook processor can process the information in order to output information shown in elements 820-870. In contrast, the average fan may not have access to such information (*e.g.*, playbooks for both teams). Therefore the playbook processor may be incapable of providing the calculations for the fan.

[0075] It may also be possible that certain information may be tagged as being authorized for viewing by particular individuals only (*e.g.*, "coach-only"). In situations where all information about offensive and defensive plays are stored on a central set of servers, such information may be defined as proprietary information for

particular users (*e.g.*, a coach or particular team) and unauthorized users (*e.g.*, fans) may not be allowed access to or utilize the information.

[0076] With reference to element 820, a section can be used to indicate the particular offensive play that is initially chosen to be run. The offensive play that is chosen may be labeled with an identification number (*e.g.*, 122). The element may be capable of opening a sub-window in order to display for the user the details of the chosen offensive play.

[0077] With reference to element 830, the user (*e.g.*, offense coach) may be capable of viewing a perceived defensive play that is currently being implemented by the defensive team. More specifically, the playbook processor may be capable of accessing and listing all known defensive plays in a list for the user to scroll through and select. The user may be capable of recognizing some patterns that can be used to identify what the defensive play may be using. The user can then select the particular defensive play and view the details of the play.

[0078] It should be noted that the database storing the potential defensive plays performed by the defensive team can be provided in a number of ways. For example, the various defensive plays of the defensive team may have been monitored in the past and inputted into the database by one or more different users (*e.g.*, scouts, players, coaches). Game footage of past games can be viewed in order to compile a database for a particular team.

[0079] In some embodiments the playbook processor may be able to provide a best detected potential defensive play (*e.g.*, element 840) based on the information already stored in the database for known defensive plays. Similar to how information about the offensive players can predict what play was performed based on the movements of one or more players, based on the positional information of one or more defensive players, the playbook processor can compile a list of potential plays from the defensive playbook. The list can then be viewed by the user in order to understand what the defensive team may be reacting to.

[0080] With reference to element 850, the playbook processor may produce a list of plays that could be used in place of the currently selected offensive play 820. The list of new plays (also referred to as counter-plays) 850 may be deemed to have a higher success rate than the previously selected offensive play 820. The user may be

capable of scrolling through the list of possible counter-plays and view details pertaining to the selected counter-play.

[0081] With reference to element 860, the chosen new play (for example, the name of the play) can be provided, for example, to the quarterback automatically. In this way, the quarterback may be capable of altering the chosen play verbally at the line of scrimmage (*i.e.* audible).

[0082] With reference to element 870, a list of the detected defensive plays and a historical success rate against the currently chosen play 820 may be provided to the user to view. The historical success rate may be based on past game data compiled. What is considered a defensive "success" may be customized by the user. For example, the user may be capable of defining success as any offensive attempt that does not gain more than a certain number of yards (*e.g.*, two or less yards allowed). Situations where the offensive play resulted in an incomplete pass or a turnover may be equivalent to zero yards gained. In any case, the user can view evaluate whether or not the currently selected offensive play 820 should be used based on the information provided in element 870.

[0083] It should be noted that other types of information may also be included within the coach and fan GUI that is not described above or illustrated in FIGURE 8. Such information may be beneficial in facilitating what play should be chosen and/or how the offense can prepare for the defensive play. For example, the coach and fan GUI 800 may further include information regarding how well the chosen offensive play has performed such as average yardage gained, first down conversion rate, and the number of touchdowns scored. This additional information may similarly be restricted, for example, such that it may only be viewed by authorized users (*e.g.*, coaches).

[0084] FIGURE 9 illustrates a flowchart 900 for the playbook processor for determining a counter play based on an observed defensive play. More specifically, the playbook processor provides the offensive team (*e.g.*, coach and/or quarterback) with a better offensive play in view of the detected defensive play.

[0085] In step 905, the playbook processor may obtain information about each of the initial position for the players on the offensive team at the line of scrimmage prior to the initiation of the play (*e.g.*, before the snap). The initial position for the

players on the offensive team may be based on an initially chosen offensive play currently being run by the quarterback.

[0086] In step 910, the playbook processor may also obtain at this time information about each of the initial positions for the players on the defensive team at the line of scrimmage prior to the initiation of the play (step 910). The initial positions for the players on the defensive team may be based on an initial chosen defensive play currently being run by the defense.

[0087] In step 915, the playbook processor can monitor any movements by one or more players on the defensive team. The movements monitored by one or more players on the defensive team may be based on, for example, the initial positions of the offensive team. The movements monitored by one or more players on the defensive team may also be based on perception by the defensive team as to what offensive play may be run by the offensive team. In any case, the movements of each of the players on the defensive team are recorded.

[0088] In step 920, the playbook processor can analyze the movements of the one or more players on the defensive team against one or more known plays in the defensive playbook. In step 925, the playbook processor attempts to identify the possible defensive plays that the defensive team is executing (*e.g.*, man-to-man coverage, blitz) based on the movements of one or more players on the defensive team.

[0089] In step 930, the information obtained regarding the movements of the one or more players on the defensive team are saved for future reference. For example, if the movements correspond to a "new" play that was not previously known by the user (*e.g.*, coach), the playbook processor can store the information for future reference.

[0090] An analysis of each of the players on the defensive team is reviewed (*e.g.*, 920-930) by the playbook processor (*e.g.*, step 935). The analysis of each of the players on the defensive team is to ensure that the best defensive play is chosen from the list of possible known defensive plays (*e.g.*, step 940). There may be more than one play corresponding to a particular movement of a player on the defensive team. With the incorporation of multiple players, however, the playbook processor can

narrow down all available plays in the defensive playbook into a few possible plays for the user to view.

[0091] In step 945, the playbook processor can provide the user with one or more counter-plays (or alternative offensive play) to use in view of the detected defensive play by the defensive team. The choice of counter-play may be based on the corresponding success rate of a particular play against the detected defense. As noted above, "success" may be customized by the user.

[0092] In step 950, the information pertaining to the counter-play may be provided, for example to the quarterback. In some embodiments, the coach may be capable of providing the information (*e.g.*, headset, signals) to the quarter back prior to the snap. Upon receiving instructions, the quarterback may be capable of changing the previously selected offensive play to the new counter-play but providing audible instructions to the other members of the offensive team. Presumably the counter-play will have a higher success rate against the detected defense than what was originally chosen as the offensive play (*e.g.*, corresponding to the initial set up in step 905).

[0093] The foregoing detailed description of the technology herein has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the technology to the precise form disclosed. Many modifications and variations are possible in light of the above teaching. The described embodiments were chosen in order to best explain the principles of the technology and its practical application to thereby enable others skilled in the art to best utilize the technology in various embodiments and with various modifications as are suited to the particular use contemplated. It is intended that the scope of the technology be defined by the claim.

[0094] Although the specification and figures may provide various embodiments directed to use of the technology herein within the realm of American football, it should be noted that the technology can be used in a variety of different events and venues including entertainment or cultural events presented at a theater, gymnasium, stadium or other facility involving a group of people. Such events may also include a variety of sporting events such as football (American and global), baseball, basketball, soccer, ice hockey, lacrosse, rugby, cricket, tennis, track and field, golf, cycling, motor sports such as automobile or motorcycle racing, horse racing,

Olympic games, and the like; cultural events such as concerts, music festivals, plays, or the opera, and the like; religious events; and more permanent exhibitions such as museums or historic homes.

CLAIMS

WHAT IS CLAIMED IS:

1. A method for identifying a recorded playbook play, the method comprising:

obtaining a location of one or more players on the offensive team;

determining that the location of the one or more players on the offensive team corresponds to an initial starting location prior to the start of a play;

recording the execution of the play by the offensive team;

evaluating the recorded execution of the play by the offensive team against one or more plays in a playbook;

identifying one or more possible plays from the playbook that best corresponds to the recorded execution of the play by the offensive team; and

displaying the one or more possible plays from the playbook for a user to view.

2. The method of claim 1, wherein the method is utilized with the sport of American football.

3. The method of claim 1, wherein the location of the one or more players on the offensive team is obtained using one or more sensors mounted, affixed, or embedded on the player.

4. The method of claim 1, wherein the recorded execution of the play includes recording the locations of the one or more players of the offensive team at regular intervals during the execution of the play.

5. The method of claim 1, wherein the identified one or more possible plays from the playbook satisfies a threshold corresponding to an allowed deviation from the play in the playbook.

6. A system for identifying a recorded playbook play, the system comprising:

a user interface; and

a processor, the processor executing instructions stored in memory to:

obtain a location of one or more players on the offensive team;

determine that the location of the one or more players on the offensive team corresponds to an initial starting location prior to the start of a play;

record the execution of the play by the offensive team;

evaluate the recorded execution of the play by the offensive team against one or more plays in a playbook;

identify one or more possible plays from the playbook that best corresponds to the recorded execution of the play by the offensive team; and

displaying the identified one or more possible plays from the playbook onto the user interface for a user to view.

7. The system of claim 6, wherein the system is utilized with the sport of American football.

8. The system of claim 6, wherein the location of the one or more players on the offensive team is obtained using one or more sensors mounted, affixed, or embedded on the player.

9. The system of claim 6, wherein the recorded execution of the play includes recording the locations of the one or more players of the offensive team at regular intervals during the execution of the play.

10. The system of claim 6, wherein the identified one or more possible plays from the playbook satisfies a threshold corresponding to an allowed deviation from the play in the playbook.

11. A method for identifying a counter offensive play based on a detected defensive play, the method comprising:

obtaining a location of one or more players on the offensive team, the location of the one or more players on the offensive team corresponding to an initial offensive play;

obtaining a location of one or more players on the defensive team, the location of the one or more players on the defensive team corresponding to an initial defensive play;

recording one or more defensive shifts by the one or more players on the defensive team, wherein the defensive shifts corresponds to adjustments of the one or more players on the defensive team to the location of the one or more players on the offensive team;

evaluating the recorded defensive shifts by the defensive team against one or more known defensive plays in a playbook;

identifying one or more possible defensive plays from the playbook that best corresponds to the recorded defensive shifts by the defensive team;

determining the best counter play from the playbook, wherein the counter play provides a better success rate than the original offensive play; and

displaying the best counter play from the playbook for a user to view.

12. A system for identifying a counter offensive play based on a detected defensive play, the system comprising:

a user interface; and

a processor, the processor executing instructions stored in memory to:

obtain a location of one or more players on the offensive team, the location of the one or more players on the offensive team corresponding to an initial offensive play;

obtain a location of one or more players on the defensive team, the location of the one or more players on the defensive team corresponding to an initial defensive play;

record one or more defensive shifts by the one or more players on the defensive team, wherein the defensive shifts corresponds to adjustments of the one or more players on the defensive team to the location of the one or more players on the offensive team;

evaluate the recorded defensive shifts by the defensive team against one or more known defensive plays in a playbook;

identify one or more possible defensive plays from the playbook that best corresponds to the recorded defensive shifts by the defensive team;

determine the best counter play from the playbook, wherein the counter play provides a better success rate than the original offensive play; and

display the best counter play from the playbook on the user interface for a user to view.

AMENDED CLAIMS
received by the International Bureau on 24 November 2015 (24.11.2015)

1. A method for identifying a recorded playbook play, the method comprising:

obtaining a location of one or more players on an offensive team;

determining that the location of the one or more players on the offensive team corresponds to an initial starting location prior to a start of a play;

recording an execution of the play by the offensive team;

evaluating the recorded execution of the play by the offensive team against one or more playbook plays in a playbook;

identifying one or more possible plays in the playbook that corresponds to the recorded execution of the play by the offensive team, wherein the one or more possible plays are identified when the play is within an allowed deviation from a playbook play; and

displaying the one or more possible plays from the playbook for a user to view.

2. The method of claim 1, wherein the method is utilized with the sport of American football.

3. The method of claim 1, wherein the location of the one or more players on the offensive team is obtained using one or more sensors mounted, affixed, or embedded on the player.

4. The method of claim 1, wherein the recorded execution of the play includes recording the locations of the one or more players of the offensive team at regular intervals during the execution of the play.

5. A system for identifying a recorded playbook play, the system comprising:

a user interface; and

a processor, the processor executing instructions stored in memory to:

obtain a location of one or more players on an offensive team;

determine that the location of the one or more players on the offensive team corresponds to an initial starting location prior to a start of a play;

record an execution of the play by the offensive team;

evaluate the recorded execution of the play by the offensive team against one or more playbook plays in a playbook;

identify one or more possible plays in the playbook that corresponds to the recorded execution of the play by the offensive team, wherein the one or more possible plays are identified when the play is within an allowed deviation from a playbook play; and

displaying the identified one or more possible plays from the playbook onto the user interface for a user to view.

6. The system of claim 5, wherein the system is utilized with the sport of American football.

7. The system of claim 5, wherein the location of the one or more players on the offensive team is obtained using one or more sensors mounted, affixed, or embedded on the player.

8. The system of claim 5, wherein the recorded execution of the play includes recording the locations of the one or more players of the offensive team at regular intervals during the execution of the play.

AMENDED SHEET (ARTICLE 19)

9. A method for identifying a counter offensive play based on a detected defensive play, the method comprising:

obtaining a location of one or more players on an offensive team, the location of the one or more players on the offensive team corresponding to an initial offensive play;

obtaining a location of one or more players on a defensive team, the location of the one or more players on the defensive team corresponding to an initial defensive play;

recording one or more defensive shifts by the one or more players on the defensive team, wherein the defensive shifts corresponds to adjustments of the one or more players on the defensive team to the location of the one or more players on the offensive team;

evaluating the recorded defensive shifts by the defensive team against one or more known defensive playbook plays in a playbook;

identifying one or more possible defensive plays in the playbook that corresponds to the recorded defensive shifts by the defensive team, wherein the one or more possible defensive plays are identified when the defensive shifts are within an allowed deviation from a defensive playbook play;

determining the best counter play from the playbook, wherein the counter play provides a better success rate than the original offensive play; and

displaying the best counter play from the playbook for a user to view.

10. A system for identifying a counter offensive play based on a detected defensive play, the system comprising:

a user interface; and

a processor, the processor executing instructions stored in memory to:

obtain a location of one or more players on an offensive team, the location of the one or more players on the offensive team corresponding to an initial offensive play;

obtain a location of one or more players on a defensive team, the location of the one or more players on the defensive team corresponding to an initial defensive play;

record one or more defensive shifts by the one or more players on the defensive team, wherein the defensive shifts corresponds to adjustments of the one or more players on the defensive team to the location of the one or more players on the offensive team;

evaluate the recorded defensive shifts by the defensive team against one or more known defensive playbook plays in a playbook;

identify one or more possible defensive plays in the playbook that corresponds to the recorded defensive shifts by the defensive team, wherein the one or more possible defensive plays are identified when the defensive shifts are within an allowed deviation from a defensive playbook play;

determine the best counter play from the playbook, wherein the counter play provides a better success rate than the original offensive play; and

display the best counter play from the playbook on the user interface for a user to view.

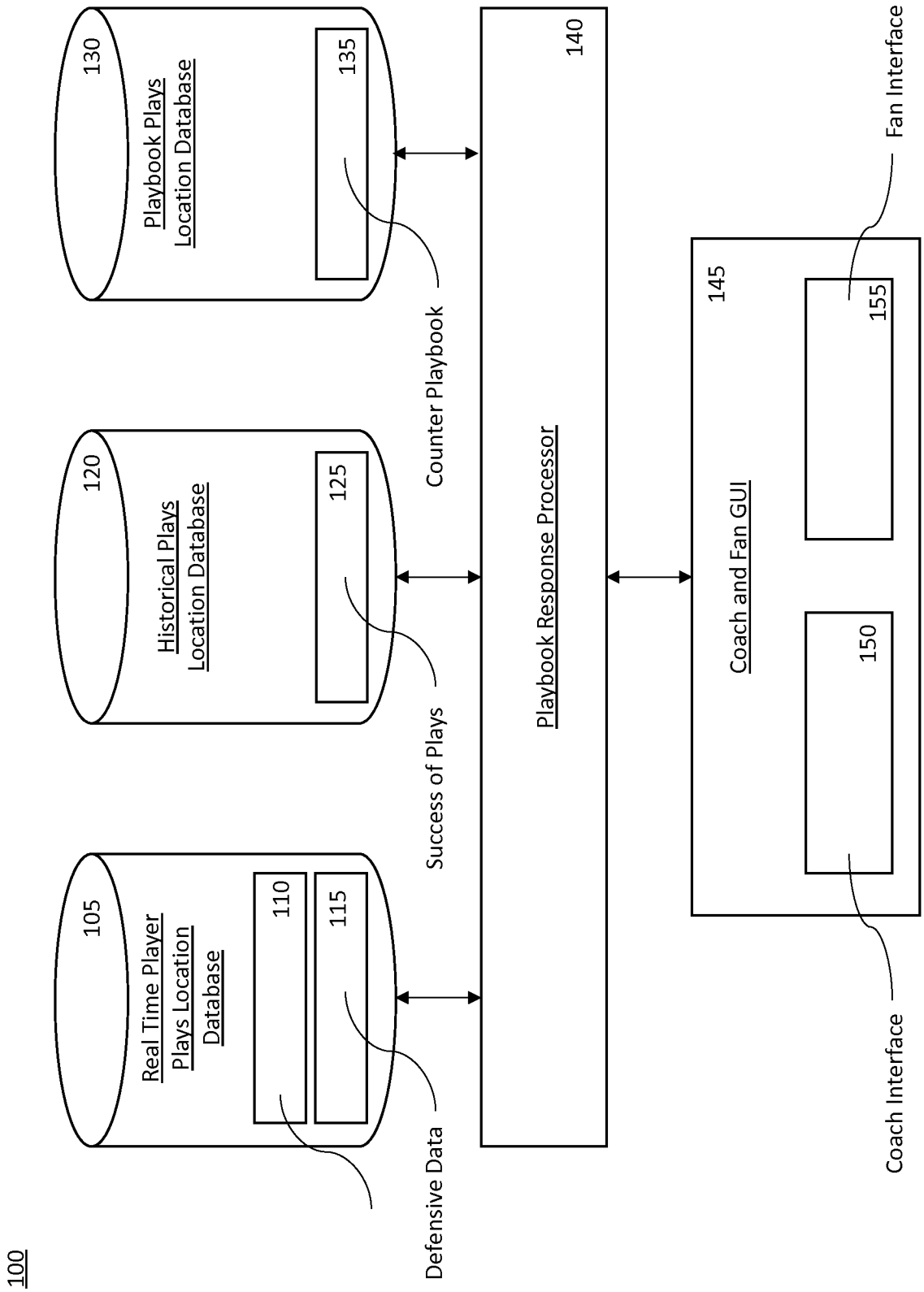
100
105
Real Time Player Plays Location Database
110
115
Defensive Data
120
Historical Plays Location Database
125
Success of Plays
130
Playbook Plays Location Database
135
Counter Playbook
140
Playbook Response Processor
145
Coach and Fan GUI
150
Coach Interface
155
Fan Interface

FIG. 1

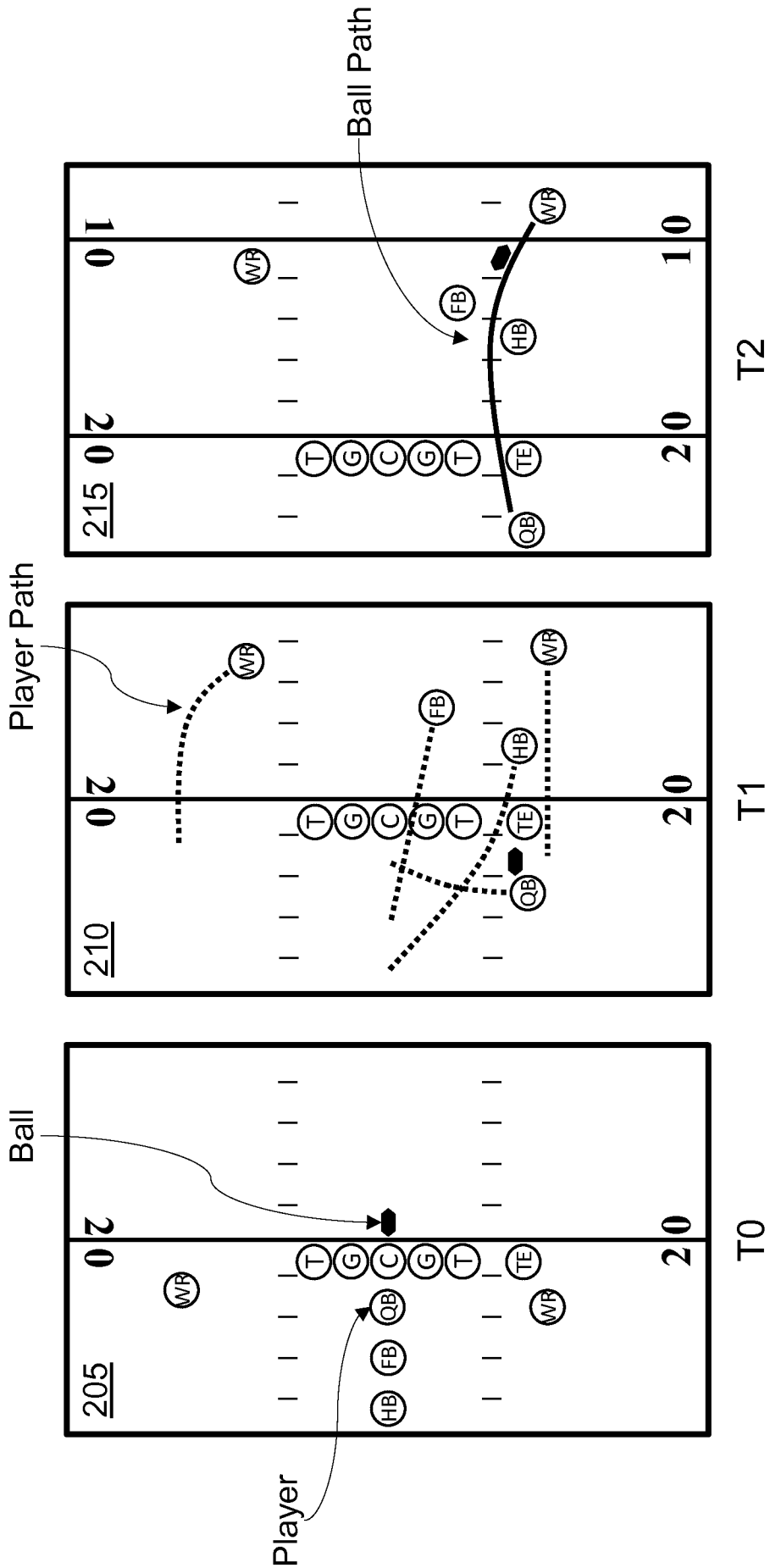
Ball Path
Player Path
Ball
Player
T0
T1
T2
205
210
215
WR
FB
HB
QB
T
G
C
TE

FIG. 2

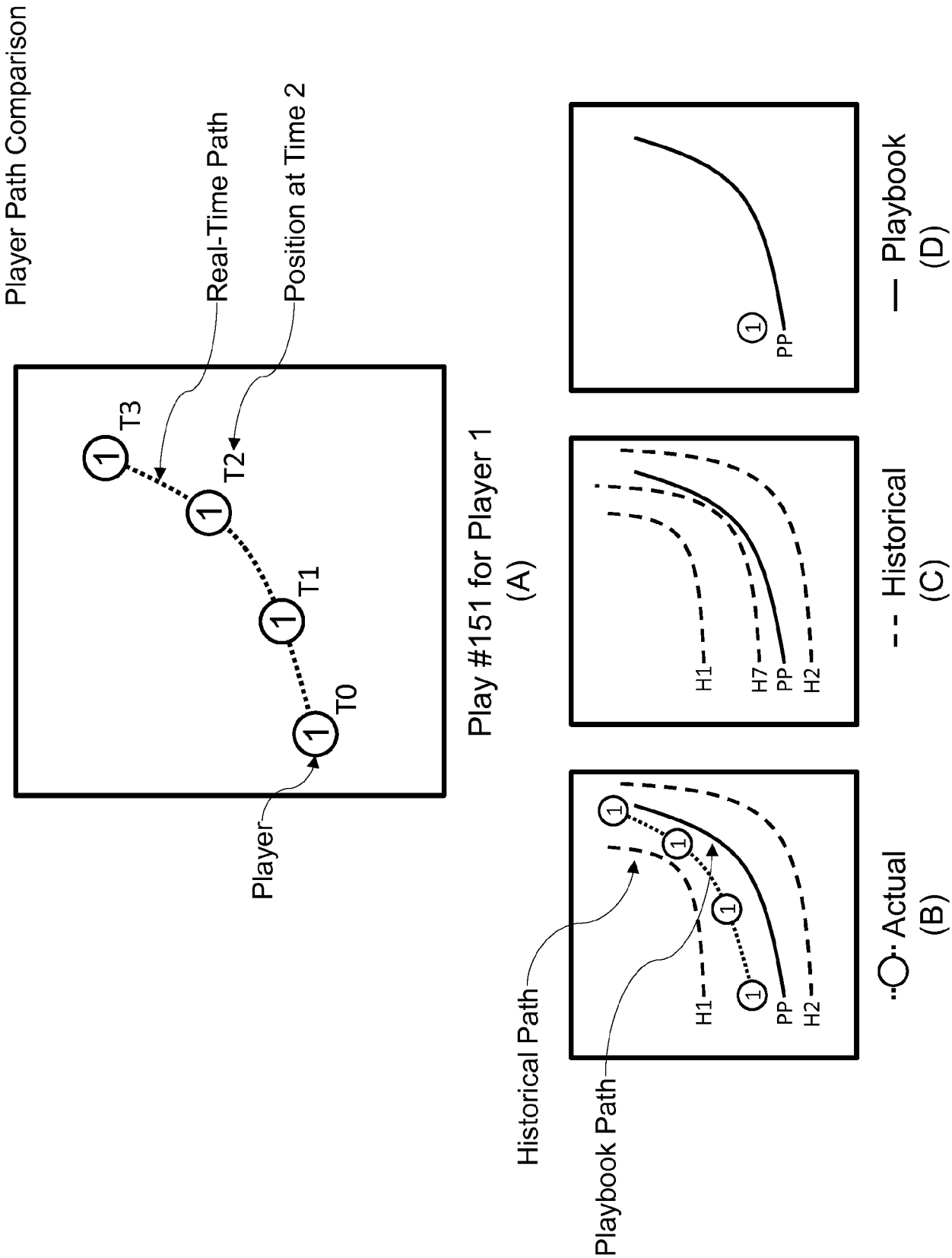
Player Path Comparison
Real-Time Path
Position at Time 2
T3
T2
T1
T0
Player
Play #151 for Player 1
(A)
Historical Path
Playbook Path
H1
PP
H2
Actual
(B)
H1
H7
PP
H2
Historical
(C)
PP
Playbook
(D)

FIG. 3

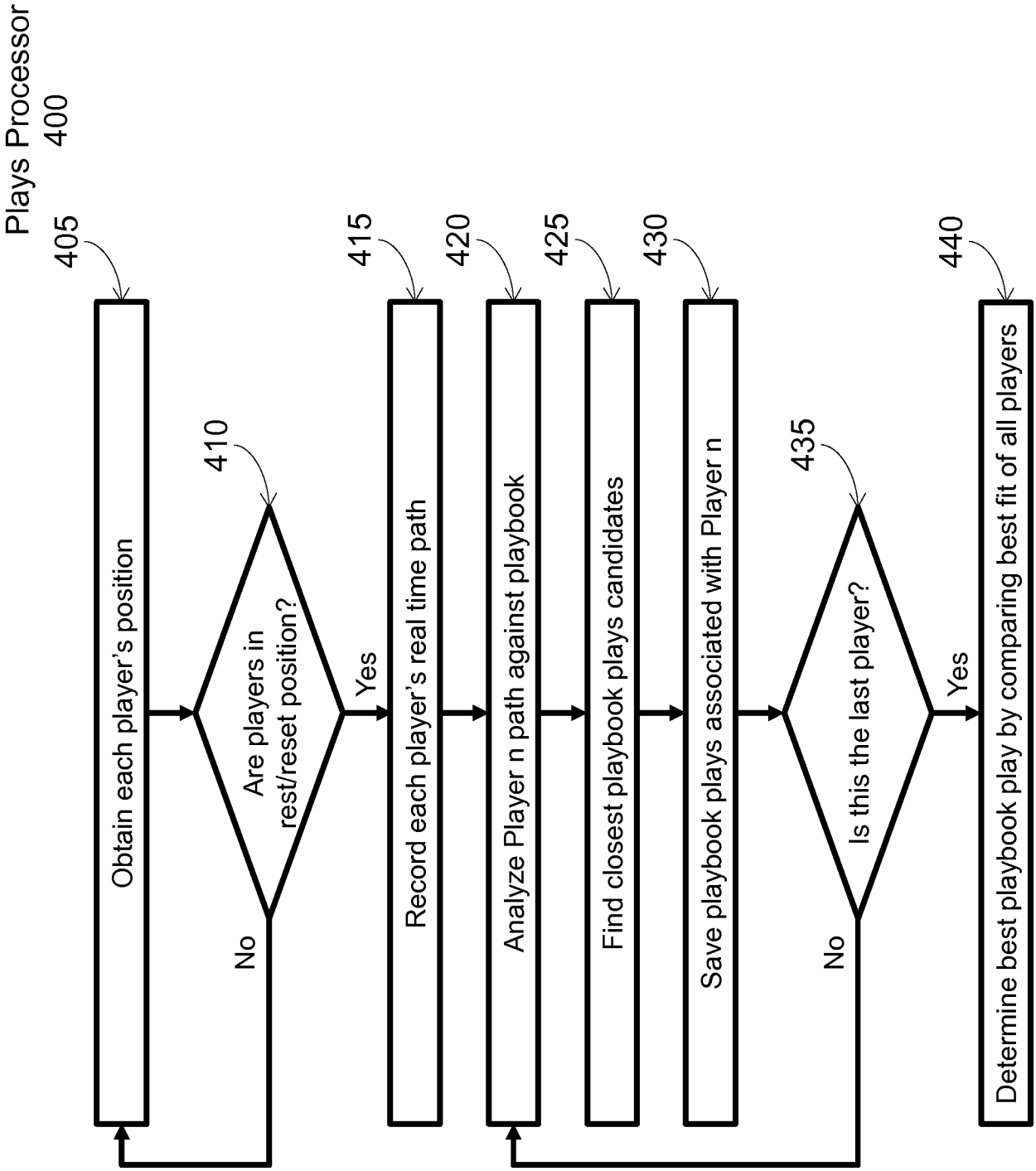
Plays Processor
400
405
Obtain each player's position
410
Are players in rest/reset position?
No
Yes
415
Record each player's real time path
420
Analyze Player n path against playbook
425
Find closest playbook plays candidates
430
Save playbook plays associated with Player n
435
Is this the last player?
No
Yes
440
Determine best playbook play by comparing best fit of all players

FIG. 4

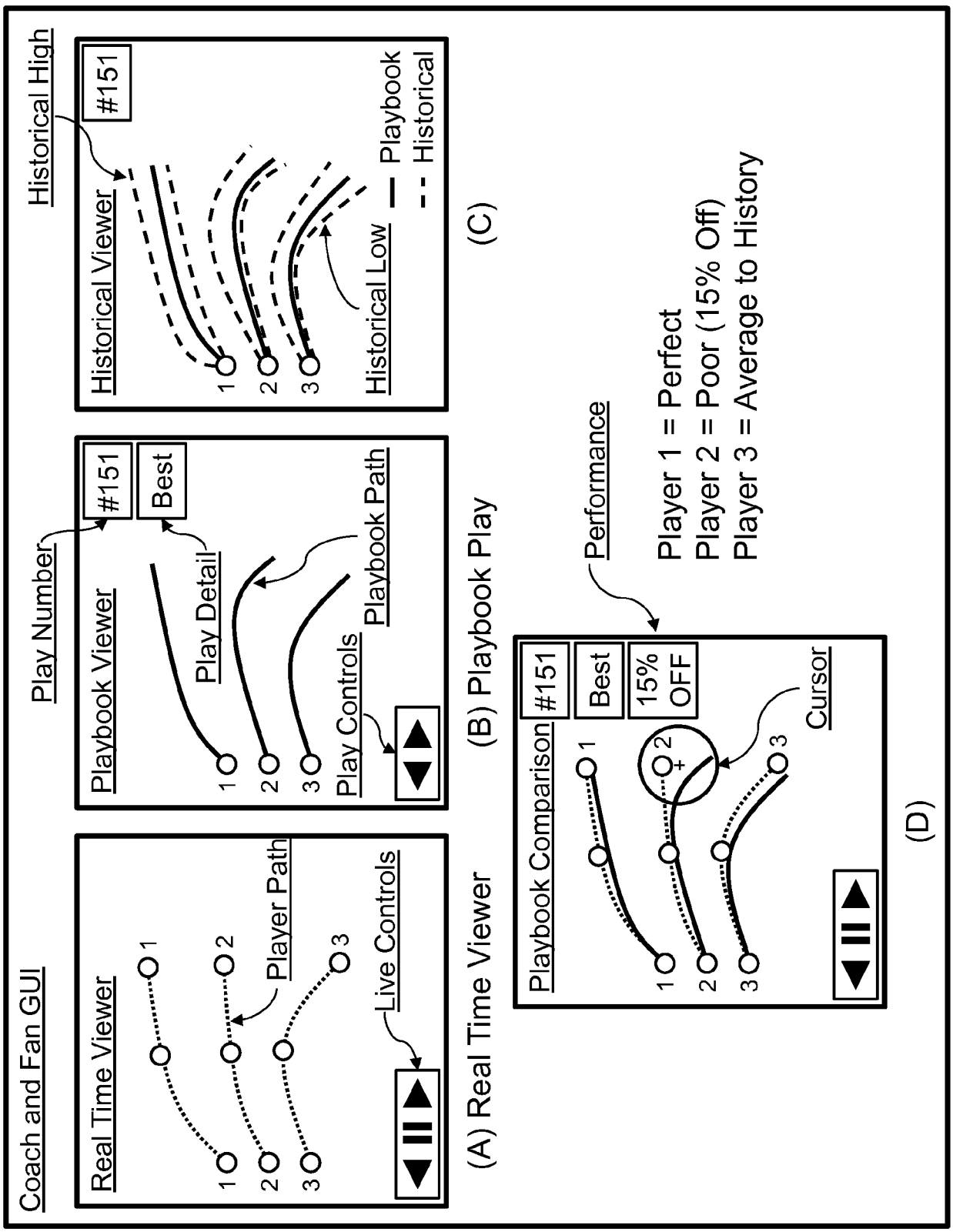
Coach and Fan GUI
Real Time Viewer
1
2
3
Player Path
Live Controls
(A) Real Time Viewer
Play Number
Playbook Viewer
#151
Best
Play Detail
Playbook Path
Play Controls
(B) Playbook Play
Historical High
Historical Viewer
#151
Historical Low
Playbook
Historical
(C)
Performance
Player 1 = Perfect
Player 2 = Poor (15% Off)
Player 3 = Average to History
Playbook Comparison
#151
Best
15% OFF
Cursor
(D)

FIG. 5

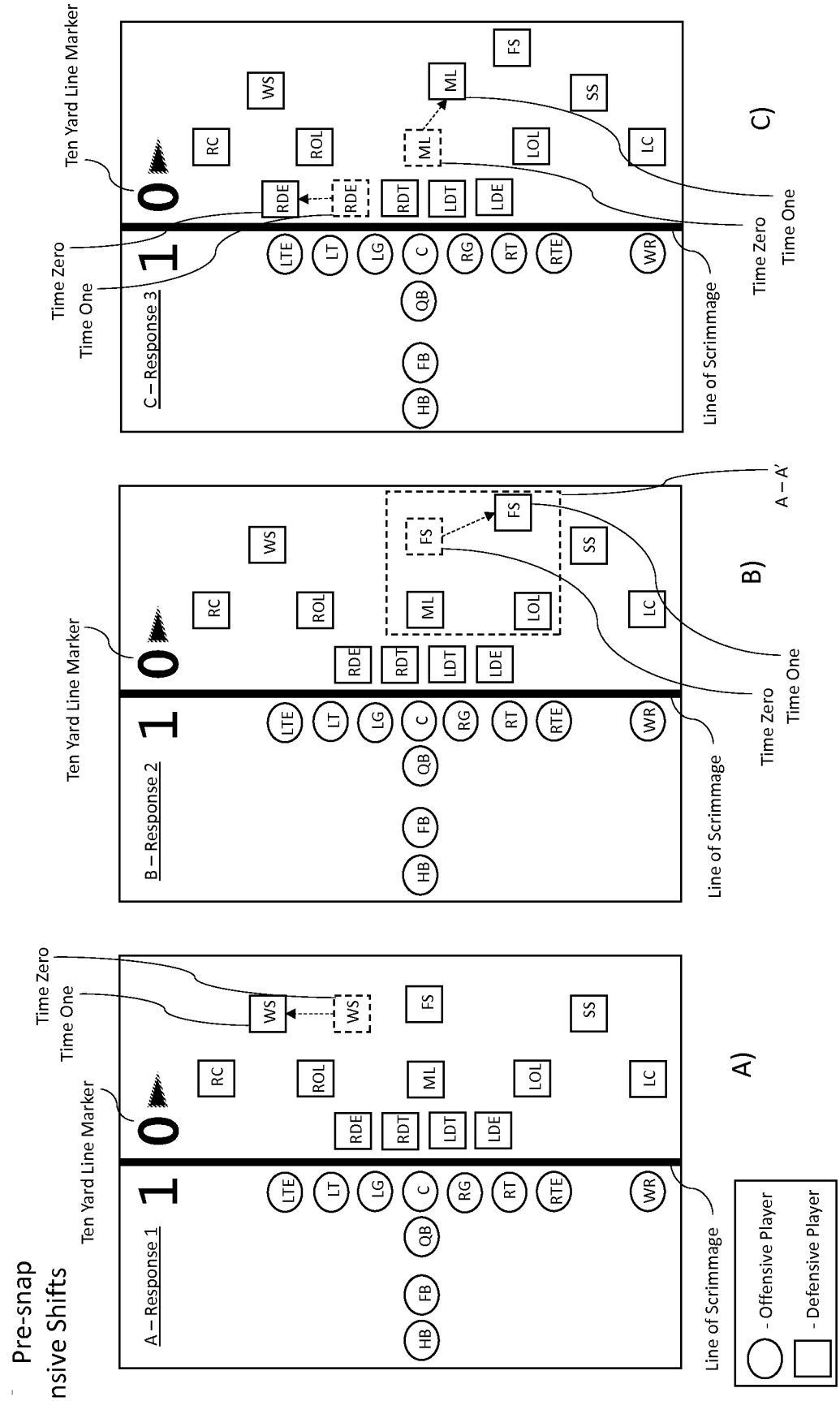
Pre-snap
Defensive Shifts
A – Response 1
B – Response 2
C – Response 3
Ten Yard Line Marker
Time Zero
Time One
Line of Scrimmage
A – A'
A)
B)
C)
- Offensive Player
- Defensive Player
LTE
LT
LG
C
RG
RT
RTE
QB
FB
HB
WR
RC
ROL
WS
RDE
RDT
LDT
LDE
ML
LOL
FS
SS
LC

FIG. 6

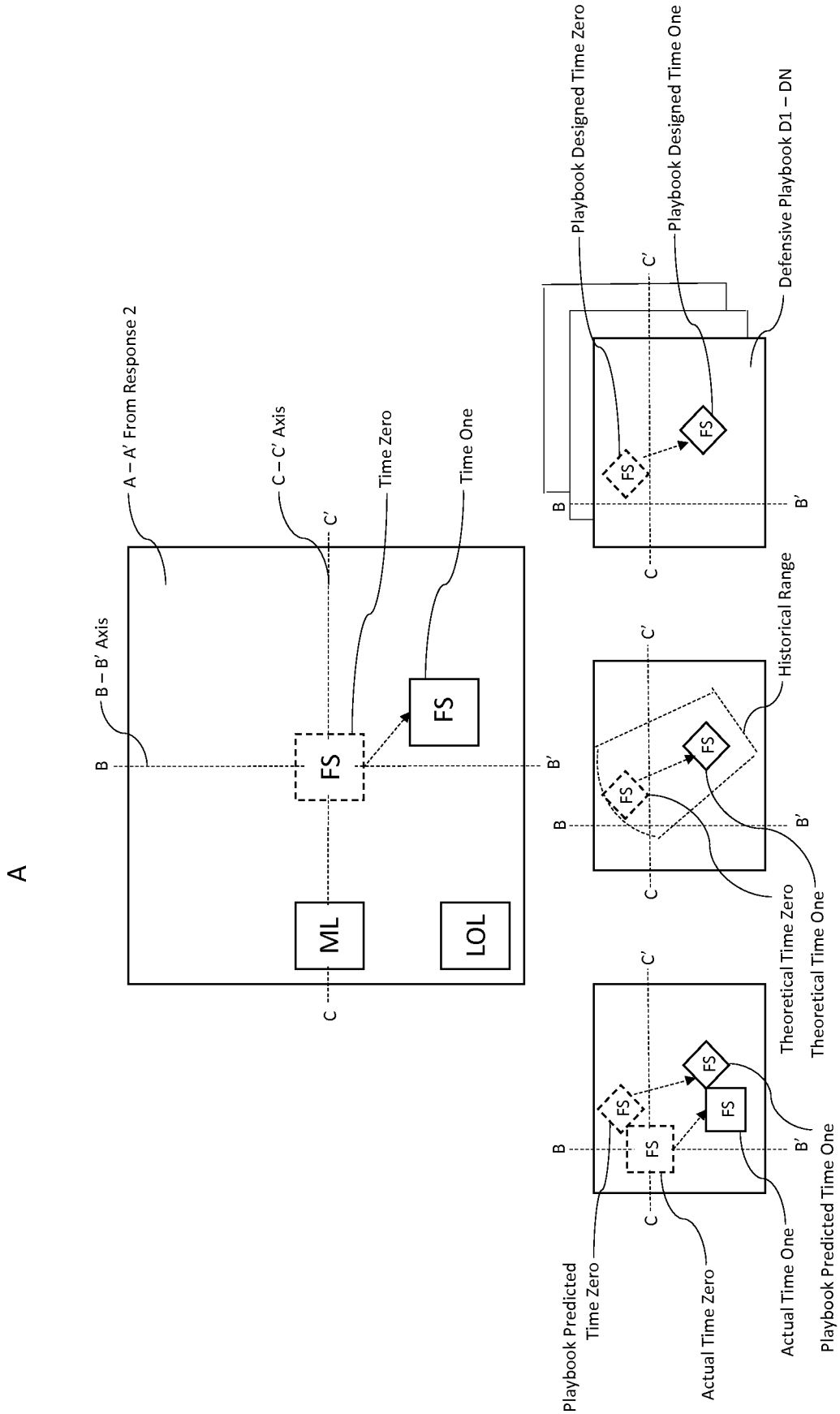
A
A – A' From Response 2
B – B' Axis
C – C' Axis
Time Zero
Time One
B
B'
C
C'
FS
ML
LOL
B
Playbook Predicted Time Zero
Actual Time Zero
Actual Time One
Playbook Predicted Time One
Theoretical Time Zero
Theoretical Time One
C
Historical Range
D
Playbook Designed Time Zero
Playbook Designed Time One
Defensive Playbook D1 – DN

FIG. 7

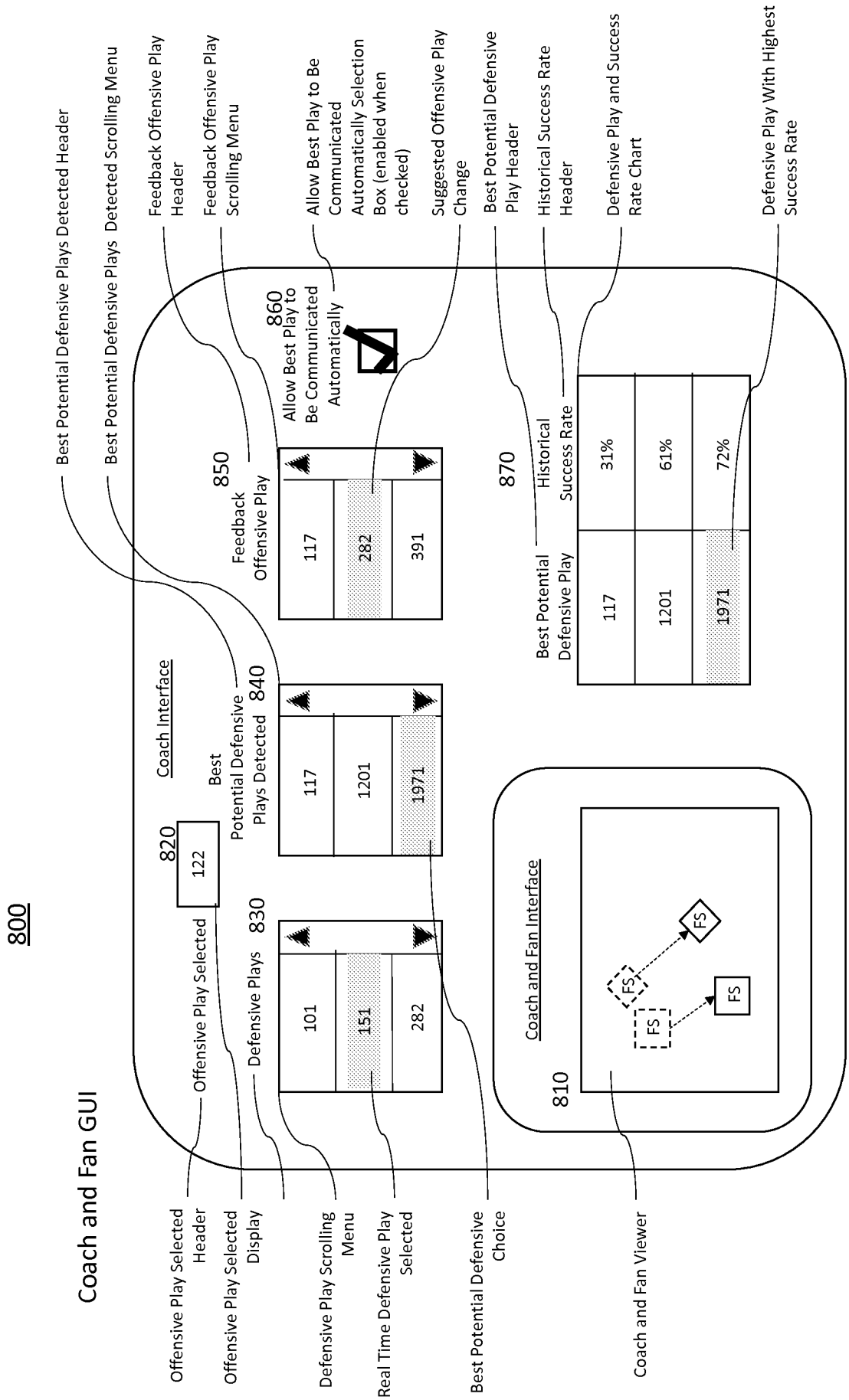
800
Coach and Fan GUI
Best Potential Defensive Plays Detected Header
Best Potential Defensive Plays Detected Scrolling Menu
Feedback Offensive Play Header
Feedback Offensive Play Scrolling Menu
Allow Best Play to Be Communicated Automatically Selection Box (enabled when checked)
Suggested Offensive Play Change
Best Potential Defensive Play Header
Historical Success Rate Header
Defensive Play and Success Rate Chart
Defensive Play With Highest Success Rate
Coach Interface
820
122
Offensive Play Selected
Best Potential Defensive Plays Detected
840
117
1201
1971
830
Defensive Plays
101
151
282
850
Feedback Offensive Play
117
282
391
860
Allow Best Play to Be Communicated Automatically
870
Best Potential Defensive Play
Historical Success Rate
117
1201
1971
31%
61%
72%
Coach and Fan Interface
810
FS
FS
FS
FS
Offensive Play Selected Header
Offensive Play Selected Display
Defensive Play Scrolling Menu
Real Time Defensive Play Selected
Best Potential Defensive Choice
Coach and Fan Viewer

FIG. 8

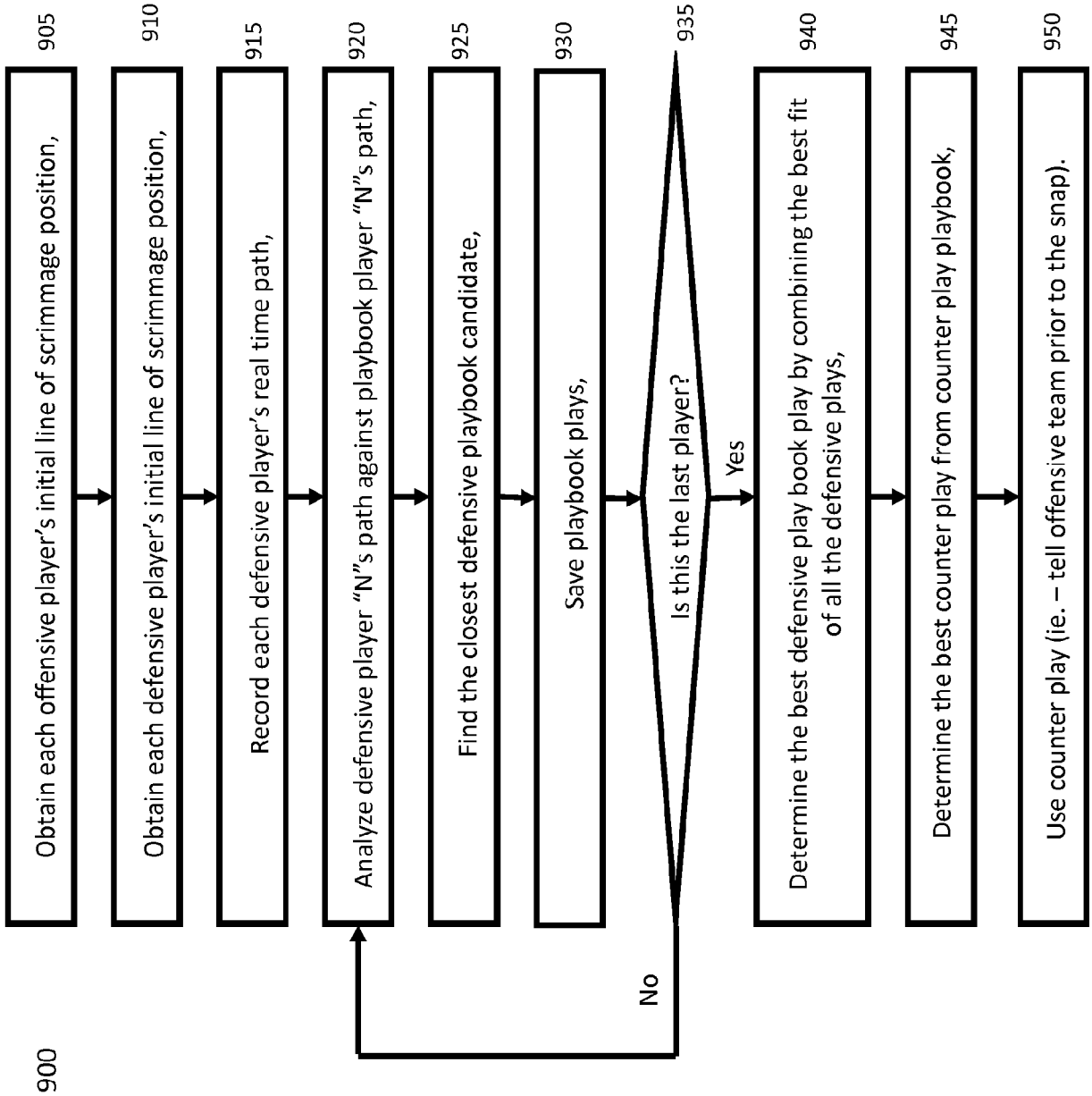
900
905
Obtain each offensive player's initial line of scrimmage position,
910
Obtain each defensive player's initial line of scrimmage position,
915
Record each defensive player's real time path,
920
Analyze defensive player "N"s path against playbook player "N"s path,
925
Find the closest defensive playbook candidate,
930
Save playbook plays,
935
Is this the last player?
No
Yes
940
Determine the best defensive play book play by combining the best fit of all the defensive plays,
945
Determine the best counter play from counter play playbook,
950
Use counter play (ie. – tell offensive team prior to the snap).

FIG. 9

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2015/040228

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - G06F 19/00 (2015.01)
CPC - G06F 19/00 (2015.04)
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC(8) - A63B 69/00; G06F 19/00 (2015.01)
USPC - 348/157; 700/91, 92, 93

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
CPC - A63B 69/00, 69/002; G06F 19/00 (2015.04) (keyword delimited)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PatBase, Orbit, Google Patents, Google Scholar, Google.
Search terms used: detect, identify, classify, play, playbook, game, sport, counter, success, rate

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2011/0169959 A1 (DEANGELIS et al.) 14 July 2011 (14.07.2011) entire document	1-3, 6-8
Y		4-5, 9-12
Y	US 2010/0030350 A1 (HOUSE et al.) 04 February 2010 (04.02.2010) entire document	11-12
Y	US 2011/0013087 A1 (HOUSE et al.) 20 January 2011 (20.01.2011) entire document	4, 9
Y	US 2012/0081531 A1 (DEANGELIS et al.) 05 April 2012 (05.04.2012) entire document	5, 10
A	US 2013/0138590 A1 (HUKE et al.) 30 May 2013 (30.05.2013) entire document	1-12

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
09 September 2015	30 SEP 2015
Name and mailing address of the ISA/ Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Authorized officer Blaine Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774