IMPLEMENTATION OF BLACKBOX TESTING IN THE PES GAME APPLICATION USING EQUIVALENT PARTITION TECHNIQUE

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Abstract

This research discusses the application of Blackbox testing techniques on the Pro Evolution Soccer (PES) game application using the equivalence partitioning method. Blackbox testing is a software testing method that focuses on the external functions of the application without examining its internal source code. Equivalence partitioning is a technique that divides input data into classes considered representative of various possible cases. The inputs provided include both valid and invalid data. The testing focuses on several main features of the game, such as login, gameplay, gameplay settings, and game settings. The problem addressed is the numerous bugs and functional issues that can disrupt the user experience, highlighting the need for an effective method to identify and categorize errors in the PES application. This research aims to identify and categorize errors and deficiencies in the PES game, thereby improving the quality and performance of the application. The test results showed a success rate of 87.5%. The findings indicate that the equivalence partitioning method is effective in detecting bugs and functional issues in the PES game, providing recommendations for further improvements.

Keywords: Game, Blackbox Testing, Equivalence Partitioning,Bug

INTRODUCTION

The game Pro Evolution Soccer (PES) is a PC software designed to provide users with a realistic and interactive soccer-playing experience. This application is developed to help players enjoy soccer simulation with in-depth features and dynamic gameplay. Key features in the PES game on PC include login, gameplay, gameplay settings, and game settings. To ensure that these features work well and the input data is accurate, testing is required.

Software testing is conducted to ensure software quality assurance and to make sure there are no errors in the system. This process ensures that all parts of the system function without errors and meet user requirements. Another goal is to produce a high-quality system with a high level of productivity. Generally, two methods are used for application testing: the white box method and the black box method.

The white box method is used to test how the application works internally. This test demonstrates the extent to which the application operates according to the procedures and specifications. In contrast, the black box method is used to test whether the application can fulfill its functions properly without examining the internal workings of the application.

Black box testing has advantages because it does not require source code access, thus not needing instrumentation or source code availability. Conversely, one might hypothesize that accessing source code using white box testing can increase code coverage and improve early bug reports. However, white box testing is also expensive, and using coverage information from previous releases can effectively reduce priority in some releases. Techniques for prioritizing white box test cases may not apply when there is no source code or instrumentation is not possible, leaving testers with no choice but to use black box testing. Therefore, in this case study, the PES game application will be tested using black box testing.

The benefit of conducting this research is to review and refine the application to ensure it meets the requirements or specifications established during the design of this book publishing recording application. This testing is performed using the Equivalence Partitioning technique. Equivalence Partitioning is a testing method based on the performance of input data in an information system application, where each input menu is tested and grouped based on its function, whether valid or not.

Equivalence Partitioning divides the program's input domain into data classes, allowing test cases to be developed based on the input and output of a component partitioned into these classes. This approach aims to obtain a dataset in the form of testing documentation using the Equivalence Partitioning method and to evaluate the effectiveness of this method. Test cases will be examined using the Equivalence Partitioning method, and the dataset containing these test cases will be evaluated for correctness.

The problem faced is the numerous bugs and functional issues that can disrupt the user experience in the PES application. Identifying and categorizing these errors is crucial for improving the quality and performance of the application. Additionally, there is a need to use effective testing methods given the limited access to source code and instrumentation in some cases. By using Black Box Testing techniques, this research aims to address these issues and provide effective recommendations for improvements in the PES game application.

The purpose of this research is to identify errors within the system to prevent any incorrect outputs before they are encountered by users. Based on the compatibility with the system application issues using the Black Box Testing method with the Equivalence Partitioning technique, a testing process is established. These steps include identifying and determining the system functions to be tested based on valid and invalid inputs.

METHODS

In this stage, the research method used will be explained to clarify the subsequent steps in this study, particularly in conducting testing using the equivalence partitioning technique. The research is conducted by following several stages: determining test cases, performing software testing, employing black box testing, applying the equivalence partitioning technique, and evaluating the results. These stages are carried out to provide a clear flow for the research process. The research flow is illustrated in Figure 1.

Figure 1. Research Design

DETERMINING TEST CASES
     The initial stage begins with preparing the software to be tested and includes planning to determine the type of testing to be used. Some features or functions of the software are tested against prepared test cases to obtain a set of data as a test document using the equivalence partitioning method and its input data.

     Software testing aims to ensure that each function within the system operates normally according to user requirements. A test case is considered good if it can identify errors or faults that were not detected initially. This testing is carried out to prevent losses and problems for both developers and users when the application is in use. In this research, testing is conducted by creating test cases on the software under test using the equivalence partitioning technique. This technique involves initializing standard grade partitions for input and output to obtain a dataset for testing and assess the software's effectiveness. The creation of a testing table containing test features and test cases is done in black box testing to verify whether the program operates according to requirement specifications.

     Table 1 shows the test cases for some key features to be tested in this application. The purpose of creating these test cases is to determine whether the application is suitable for use by users.

Table 1. Test case testing design

TEST CODE	INPUT DESCRIPTION	EXPECTED OUTPUT
TC01	Writing Username: "ABCD1234"	Valid Username
TC02	Writing Username: "ABCD1234" (with spaces)	Username Invalid, error message appears
TC03	Writing Password: "abcdefgh"	Valid Password
TC04	Writing Password: "abcd efgh" (with spaces)	Invalid Password, error message appears
TC05	Dribbling the ball with the left joystick	Player moves and dribbles the ball
TC06	Dribbling the ball with the right joystick	Player doesn't move and doesn't dribble the ball
TC07	Stealing the ball with the X button	Player steals the ball from the opponent
TC08	Stealing the ball with the Δ (triangle) button	Player doesn't steal the ball from the opponent
TC09	Passing to the intended player	Ball will be passed to the intended player
TC10	Passing to a non-existent player	Ball will go out of bounds or not reach the intended player
TC11	Passing with the X button	Ball will be passed
TC12	Passing with the square button	Ball will not be passed
TC13	Shooting towards the goal	Ball will aim towards the goal
TC14	Shooting outside the goal	Ball will aim outside the goal
TC15	Kicking the ball with the square button	Player will kick the ball
TC16	Kicking the ball with the Δ (triangle) button	Player will not kick the ball
TC17	Press "Start" button to open the main menu	Main menu will open

TC18	Press "Δ" (triangle) button to open the main menu	Main menu will not open
TC19	Press "Options" button to open the settings menu	Settings menu will open
TC20	Press "X" button to open the settings menu	Settings menu will not open
TC21	Press "Select" button to open the statistics menu	Statistics menu will open
TC22	Press "Square" button to open the statistics menu	Statistics menu will not open
TC23	Choose desired formation from the list	Formation will be selected as per choice
TC24	Choose formation not available or customize formation	Formation will not be selected and revert to default
TC25	Use left joystick to select player to be moved	Player can be selected and moved
TC26	Use right joystick to select player to be moved	Player cannot be selected and moved
TC27	Press and hold the X button to select and move player to desired position	Player is selected and can be moved
TC28	Press and hold the Δ (triangle) button to select and move player to desired position	Player is not selected and cannot be moved
TC29	Press "X" button to select substitute player and press "X" again to select player to be substituted	Player is selected and can be substituted
TC30	Press "square" button to select substitute player and press "square" again to select player to be substituted	Player is not selected and cannot be substituted
TC31	Use left joystick to determine kicking direction	Kicking direction will change as desired
TC32	Use right joystick to determine kicking direction	Kicking direction will not change as desired
TC33	Press "Square" button to perform kick	Player will perform kick
TC34	Press "O" button to perform kick	Player will not perform kick
TC35	Move player towards the board using left analog stick	Player moves towards the board and is obstructed by the board
TC36	Move player towards the board using right analog stick	Player does not move towards the board
TC37	Move player towards the referee using left analog stick	Player moves towards the referee and collides with the referee
TC38	Move player towards the referee using right analog stick	Player does not move towards the referee
TC39	Searching for opponent with stable signal network	Opponent is found easily
TC40	Searching for opponent with poor network (turning off wifi)	Unable to find opponent

TC41	Player transfer with reasonable amount	Player can be transferred to a club
TC42	Player transfer with unreasonable amount	Player cannot be transferred to a club
TC43	Selecting Easy, Medium, Hard level	Game level corresponds to selection
TC44	Selecting Super Hard level	Game level is not valid
TC45	Manual game control	Valid manual game control
TC46	Automatic game control	Invalid automatic game control
TC47	Dynamic camera remains	Valid dynamic camera
TC48	First person camera	Invalid first person camera or game does not support
TC49	Selecting resolution 1920x1080, 1280x720	Resolution is valid for the game
TC50	Selecting Resolution 1000x800	Resolution is not valid
TC51	Selecting High, Medium, Low graphics	Graphics are valid as per selection
TC52	Selecting Very High graphics	Graphics are not valid and not supported on the device
TC53	Selecting Joystick Control	Game control is valid
TC54	Selecting Keyboard Control	Game control is not valid
TC55	Selecting desired character or player using X button	Character is successfully selected and matches the original
TC56	Selecting desired character or player using O button	Character or player is not successfully selected

SOFTWARE TESTING

In this stage, software testing is conducted on the PES game application. The testing will be performed using a laptop as the device for running the application. Several features or functions to be tested include login, gameplay, gameplay settings, and game settings.

BLACKBOX TESTING

Black Box Testing is a method of testing an application based on functional details without examining the internal structure or source code. This testing ensures that the input and output functions of the application meet the required specifications. The testing method used is black box testing, which focuses on detailed testing of the PES game application's features and functionalities. Black box testing does not involve checking the program's source code but instead verifies the features and functionalities of the operating program. Therefore, the main focus of this testing is on the output based on the provided input and the functionality of each feature. Black box testing tends to identify issues such as incorrect or missing functionality.

EQUIVALENCE PARTITIONING TECHNIQUE

Equivalence Partitioning is a technique of Black Box testing that breaks down or divides program inputs into several partitions or classes to obtain test cases. The design of equivalence partition test cases is based on assessing classes of input conditions that describe a set of conditions that are either valid or invalid. In this stage, the equivalence partitioning technique is used by dividing inputs into several classes with valid and invalid outcomes. Then, test cases are created based on the outcomes

of each class. To determine whether the input data is valid or invalid, equivalence is established if the input condition requires a specific value.

RESULTS AND DISCUSSION

Testing is an important stage in software or system development, where various features and functionalities are examined to ensure that the system operates properly according to the established specifications. In this case, black box testing using the equivalence partitioning technique is applied to the PES game application, with several key features being tested such as login, gameplay, gameplay rules, and game settings.

The results of this testing allow us to determine to what extent the use of the PES game application meets the established expectations and standards. Below is an explanation of the results and discussion of each table.

Table 2 shows that several test cases in this PES game application are provided with both valid and invalid inputs, along with the expected outputs and the actual results after testing, indicated by success and failure markers.

Table 2. Testing results

TEST CODE	INPUT DESCRIPTION	EXPECTED OUTPUT	RESULT	CONCLUSION
TC01	Writing Username: "ABCD1234"	Valid Username	Username is valid	Successful
TC02	Writing Username: "ABCD1234" (with spaces)	Username Invalid, error message appears	Username is invalid, error message appears	Successful
TC03	Writing Password: "abcdefgh"	Valid Password	Password is valid	Successful
TC04	Writing Password: "abcd efgh" (with spaces)	Invalid Password, error message appears	Password is invalid, error message appears	Successful
TC05	Dribbling the ball with the left joystick	Player moves and dribbles the ball	Player moves and dribbles the ball	Successful
TC06	Dribbling the ball with the right joystick	Player doesn't move and doesn't dribble the ball	Player does not move and does not dribble the ball	Successful
TC07	Stealing the ball with the X button	Player steals the ball from the opponent	Player steals the ball from the opponent	Successful
TC08	Stealing the ball with the Δ (triangle) button	Player doesn't steal the ball from the opponent	Player does not steal the ball from the opponent	Successful
TC09	Passing to the intended player	Ball will be passed to the intended	Ball will be passed to the intended	Successful

		player	player	
TC10	Passing to a non-existent player	Ball will go out of bounds or not reach the intended player	Ball remains passed towards teammate	Failed
TC11	Passing with the X button	Ball will be passed	Ball will be passed	Successful
TC12	Passing with the square button	Ball will not be passed	Ball will not be passed	Successful
TC13	Shooting towards the goal	Ball will aim towards the goal	Ball will aim towards the goal	Successful
TC14	Shooting outside the goal	Ball will aim outside the goal	Ball continues to aim towards the goal	Failed
TC15	Kicking the ball with the square button	Player will kick the ball	Player will kick the ball	Successful
TC16	Kicking the ball with the Δ (triangle) button	Player will not kick the ball	Player will not kick the ball	Successful
TC17	Press "Start" button to open the main menu	Main menu will open	Main menu will open	Successful
TC18	Press "Δ" (triangle) button to open the main menu	Main menu will not open	Main menu will not open	Successful
TC19	Press "Options" button to open the settings menu	Settings menu will open	Settings menu will open	Successful
TC20	Press "X" button to open the settings menu	Settings menu will not open	Settings menu will not open	Successful
TC21	Press "Select" button to open the statistics menu	Statistics menu will open	Statistics menu will open	Successful
TC22	Press "Square" button to open the statistics menu	Statistics menu will not open	Statistics menu will not open	Successful
TC23	Choose desired formation from the list	Formation will be selected as per choice	Formation will be selected according to choice	Successful
TC24	Choose formation not available or customize formation	Formation will not be selected and revert to default	Formation will not be selected and return to the initial formation	Successful

TC25	Use left joystick to select player to be moved	Player can be selected and moved	Player can be selected and moved	Successful
TC26	Use right joystick to select player to be moved	Player cannot be selected and moved	Player cannot be selected and moved	Successful
TC27	Press and hold the X button to select and move player to desired position	Player is selected and can be moved	Selected player can be moved	Successful
TC28	Press and hold the Δ (triangle) button to select and move player to desired position	Player is not selected and cannot be moved	Player is not selected and cannot be moved	Successful
TC29	Press "X" button to select substitute player and press "X" again to select player to be substituted	Player is selected and can be substituted	Selected player can be substituted with desired player	Successful
TC30	Press "square" button to select substitute player and press "square" again to select player to be substituted	Player is not selected and cannot be substituted	Player is not selected and cannot be substituted with desired player	Successful
TC31	Use left joystick to determine kicking direction	Kicking direction will change as desired	Kicking direction will change as desired	Successful
TC32	Use right joystick to determine kicking direction	Kicking direction will not change as desired	Kicking direction will not change as desired	Successful
TC33	Press "Square" button to perform kick	Player will perform kick	Player performs a kick	Successful
TC34	Press "O" button to perform kick	Player will not perform kick	Player does not perform a kick	Successful
TC35	Move player towards the board using left analog stick	Player moves towards the board and is obstructed by the board	Player moves towards board and penetrates the board	Failed
TC36	Move player towards the board using right analog stick	Player does not move towards the board	Player does not move towards the board	Successful

TC37	Move player towards the referee using left analog stick	Player moves towards the referee and collides with the referee	Player moves towards referee and does not collide with referee	Failed
TC38	Move player towards the referee using right analog stick	Player does not move towards the referee	Player does not move towards referee	Successful
TC39	Searching for opponent with stable signal network	Opponent is found easily	Cannot easily find an opponent	Failed
TC40	Searching for opponent with poor network (turning off wifi)	Unable to find opponent	Cannot find an opponent	Successful
TC41	Player transfer with reasonable amount	Player can be transferred to a club	Player can be transferred to a club	Successful
TC42	Player transfer with unreasonable amount	Player cannot be transferred to a club	Player can still be transferred to a club	Failed
TC43	Selecting Easy, Medium, Hard level	Game level corresponds to selection	Game level matches what is stated	Successful
TC44	Selecting Super Hard level	Game level is not valid	Game level is not valid	Successful
TC45	Manual game control	Valid manual game control	Manual game control is valid	Successful
TC46	Automatic game control	Invalid automatic game control	Game control is not valid	Successful
TC47	Dynamic camera remains	Valid dynamic camera	Dynamic camera remains valid	Successful
TC48	First person camera	Invalid first person camera or game does not support	First-person camera is not valid or game does not support it	Successful
TC49	Selecting resolution 1920x1080, 1280x720	Resolution is valid for the game	Resolution matches the game or is valid	Successful
TC50	Selecting Resolution 1000x800	Resolution is	Resolution is	Successful

		not valid	not valid	
TC51	Selecting High, Medium, Low graphics	Graphics are valid as per selection	Graphics are valid as per choice	Successful
TC52	Selecting Very High graphics	Graphics are not valid and not supported on the device	Graphics are not valid and not supported on the device	Successful
TC53	Selecting Joystick Control	Game control is valid	Game control is valid	Successful
TC54	Selecting Keyboard Control	Game control is not valid	Game control is not valid	Successful
TC55	Selecting desired character or player using X button	Character is successfully selected and matches the original	Character is successfully selected but does not match the original player	Failed
TC56	Selecting desired character or player using O button	Character or player is not successfully selected	Character or player is not successfully selected	Successful

After completing the tests, the final step is to evaluate the results. Based on the testing outcomes, a variety of results were obtained, with some tests passing and others failing. Out of the 56 test cases for the PES game application, 7 did not meet the expected criteria. Despite 49 successful test cases, there are still areas for improvement in the output generated by the application. Further details are provided in Table 3.

Table 3. Recommendations and Evaluation of Results

TEST CASE	THE GENERATED OUTPUT	RECOMMENDATION
TC10	Ball remains passing towards teammate	The ball passing towards an empty space or no player should not be directed towards a teammate
TC14	Ball remains aiming at the goal	A ball kicked towards outside of the goal should result in the ball going out and not aiming at the goal
TC35	Player moves towards the board and penetrates it	The player should collide with the board or be obstructed by it, not penetrate it
TC37	Player moves towards the referee and penetrates the referee or doesn't collide with the referee	The player should collide with the referee and not penetrate them

TC39	Unable to easily find an opponent	Should be able to easily find an opponent due to stable network or connection
TC42	Player can still be transferred to a club	The player should not be able to be transferred to a club because the price is not appropriate or unreasonable
TC55	Character successfully selected but character or player doesn't match the original player	The selected character should match or be the same as the original player

Testing on the game application revealed that 11.50% of the test cases resulted in failure, while 87.50% were successful. Although only 11.50% of the test cases failed, it is important to note that these failures occurred in crucial features. Based on the obtained results, it is recommended to make improvements to ensure that the game application can be used satisfactorily by users and to facilitate its continued evolution for the better.

CONCLUSION

Testing the program is crucial to ensure that it functions as desired and to reduce the likelihood of errors. In this study, black box testing using equivalence partitioning techniques was conducted on the PES game application. The test results revealed varied outcomes, with some tests succeeding and others failing. Out of the 56 test cases conducted, 7 did not meet expectations. Despite the 49 successful test cases, there are areas that require improvement in the application's output. Specifically, 11.50% of the test cases failed, while 88.50% were successful. Although the failure rate is relatively low, it is important to note that these failures occurred in critical feature functions. Based on these results, it is recommended to make improvements to ensure that the PES game application provides a satisfactory experience for users and continues to evolve for the better.

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