P-Soccer: Soccer Games Application using Kinect

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Abstract. This paper presents a soccer game application called P-Soccer that uses Kinect as the interaction medium between users and the game characters. P-Soccer focuses on training penalty kicks with one character who is taking the kick. This game is developed based on the Game Development Life Cycle (GDLC) methodology. Results for alpha and beta testing showed that the target users are satisfied with overall game design and theme as well as the interactivity with the main character in the game.

1. Introduction

Soccer or association football is among the well-known sports in Malaysia and the world. Soccer is a team sport that is currently at rise and popular in Southeast Asia continent. There are various types of football tournaments which witnessed by people around the world such as the Barclays Premier League (England), the Spanish League, World Cup and etc. Eleven individual players are required to complete a football team on the field. As for penalties, only one individual player involved for each team. A forward may take the penalty while a goalkeeper will protect the goal from be conceded.

Nowadays there are various forms of football games applications that have been developed to assist players performing training either computer or mobile phone platform based. The Penalty Shoot-out and Soccer 2015 Fast Reflex is among existing gaming applications that already be developed. Therefore, the P-SOCCER gaming application that uses the Kinect technology was developed to assist players in training. Kinect is a technology where the device provides a natural user interface for the users to interact with the application without physical contact to any device [4]. This technology has introduced a new experience to the application users with a more flexible and intuitive interaction. In the proposed P-Soccer games application, Kinect is integrated with the game to allow game players to interact with Kinect while training the penalty kicks.

Based on observations of some existing applications, most applications use different type of platforms and also different type of interaction between users and applications. Kinect technology is a technology that introduce a new mode of interaction that allow the users to use their body movement. The objective of this project is to design and develop a soccer game application based on strategic module of football training. The proposed application is then integrated with the Kinect technology to provide a more intuitive and interactive behavior in game.
The remaining of this paper proceeds as follows. Section II presents existing games most similar to the proposed P-Soccer, Section III presents the methodology, covering from eliciting user requirements, game design, storyboard, and implementation. Section IV reports on the testing and finally Section V concludes with some planning for future works.

2. Related Work

The earliest games application is called ‘Pong’ the Atari Inc. in 1972 [6]. There are many genres in games development including the action genre, informational games, sports, educational and many others. In sports, two existing games most similar to the proposed P-Soccer are the Fast Reflex Soccer and Penalty Shootout. In Fast Reflex Soccer, the game is in the form of 2D on mobile platform. Users can choose whether to enter single play or dual play. The module ‘Practice’ allows users to train before the actual game. The gameplay shows a gray circle and users have to touch the screen to begin kick. The user has to score the goal when the circle changes color from grey to red. Figure 1 shows the interface for Fast Reflex Soccer games.

![Figure 1. Fast Reflex Soccer](image1)

In Penalty Shootout, users have to choose a team and are given five attempts to take the penalty. The user with the highest score will get the highest mark and win the round. To kick the ball, user has to choose the direction by calibrating the angle. Figure 2 shows the interface for Penalty Shootout games.

![Figure 2. Penalty Shootout](image2)

Table 1 shows the feature comparison between the proposed P-Soccer application against existing games. The comparison takes into account the interface dimension, number of modules, interaction modes, and application platform.
### Table 1. Comparison of Application Technologies

| Module                  | Penalty Shootout | Fast Reflex Soccer | P-Soccer |
|-------------------------|------------------|--------------------|----------|
| Dimension               | 2D               | 2D                 | 3D       |
| Module                  | Three modules:   | Three modules:     | Two modules: |
|                         | • Play           | • Choose Player    | • Play   |
|                         | • Highscore      | • Practice         | • Info   |
|                         | • More Games     | • Choose Character |          |
| Interaction Mode        | Mouse            | Touchscreen        | Kinect Device |
| Platform                | Desktop          | Mobile Smartphone  | Desktop  |

3. **Methodology**

The methodology adopted to develop the proposed P-Soccer games is the Game Development Life Cycle (GDLC). GDLC consists of five phases, which are initiation, pre-production, production, testing, and the release.

- **Initiation**: Initiation stage begins with seeding ideas. Among the early decisions include identifying common problems in soccer training, the development platform, target users and technologies to support the game development.

- **Pre-production**: Pre-production involves the game design including the application genre, characters, and the types of user interaction that will be supported. In P-Soccer, the genre is games and there is only one character involved, who is the player taking the penalty kick. Aside the main character, other important element in the design is the real environment, which includes the field, goalposts, and spectators in the stadium.

- **Production**: Production is the most important phase in GDLC methodology, which involves production of game assets, source code, and integration between the two elements. The game is then connected to the Kinect device.

- **Testing**: Testing involves two phases, which are alpha testing and beta testing. Alpha testing is set to evaluate the games itself, which includes functionality testing, device integration, and character matching.

- **Release**: Deployment of the P-Soccer games. All assets and models are integrated using the Unity 3D software.

3.1. **User requirements**

The target users for P-Soccer are the soccer varsity players for Universiti Tun Hussein Onn Malaysia (UTHM). System requirements are elicited from the coach, who also identified the target users among the midfielders and attackers. According to the coach, the most important aspect in taking penalty kicks is the accuracy of the kick. To emphasize this importance, P-Soccer provides three views in the game: (1) player position, (2) target, and (3) the kick itself. The main character in P-Soccer responds to the movement of the game player based on interactivity provided by the Kinect technology.

3.2. **Game design**

Graphical design is important in game development. The main objective of design in P-Soccer is interactivity and intuitivity. The design for models are also in accordance to the metaphors and environment based on the application theme and suitable for target users. P-Soccer, was
developed using the Kinect device v.1, which is primarily used for tracking user movement when playing this games. The software used was the Kinect Studio: Kinect Developer Toolkit v1.7. This software is important to track and display real environment via the Kinect device camera.

Other softwares used to develop P-Soccer include Adobe Flash Professional and Adobe Photoshop CS6 for interface design, Audacity for audio, Autodesk 3Ds Max 2016 for model design, and finally Unity 3D version 5.2.1 as the development platform. Figure 3 shows the interactive button for the main modules in P-Soccer, which are Play and Info.

![Figure 3. Buttons in P-Soccer](image)

Figure 4 shows joint matching among characters in P-Soccer.

![Figure 4. Characters in P-Soccer](image)

3.3. Storyboard
In the storyboard, there are three main scenes. Figure 5 shows the main scene in P-Soccer with two buttons; Play and Info.

![Figure 5. Main Interface of P-Soccer](image)

Figure 6 shows the camera views for P-Soccer, which include the ball, goalpost, and spectator seats. The main character involved in this scene is the player who is taking the penalty kick. Finally, Figure 7 shows the third scene that includes the Play button.
3.4. Implementation
All the assets involved in this application is organized in a file named ‘KinectSoccer’. The mainframe for P-Soccer was developed using the Unity 3D. Figure 8 shows the model development in Unity 3D. Figure 9 shows the use of Adobe Flash CS6 to develop the buttons in P-Soccer.
4. Testing
Two types of application testing were applied to P-Soccer, which are alpha testing and beta testing. Alpha testing focused on button functionalities, properties setting, and response between the Kinect device and P-Soccer. Beta testing was carried out among the target users, who are varsity soccer players at Universiti Tun Hussein Onn Malaysia (UTHM), Malaysia. There were four groups involved based on player positions. Beta testing used the questionnaire as the medium to record the response. Two main components in the questionnaire are (1) gameplay and (2) functionality testing. Table 2 shows the responses for gameplay.

| Table 2. Comparison of Application Technologies |
|------------------------------------------------|
| 1 | 2 | 3 | 4 | 5 |
| Application is easy to play | 75% | 25% |
| Background and properties suits the game theme | 25% | 75% |
| Characters are suitable and interesting | 50% | 50% |
| Music background has positive effects to the game | 25% | 50% | 25% |
| Character animation is suitable and interesting | 50% | 50% |
| Multimedia elements are suitable with the game theme | 25% | 75% |

According to the Likert scale, 1 being the highly disagree and 5 being highly agree. Using the same scale, Table 3 shows the results for functional testing. Overall, the target users responded well to the proposed P-Soccer games.

| Table 3. Comparison of Application Technologies |
|------------------------------------------------|
| 1 | 2 | 3 | 4 | 5 |
| Tracking device is working properly | 100% |
| Navigation buttons are working properly | 25% | 75% |
| Characters are easy to control | 25% | 75% |
| Screen quality is very good | 25% | 50% | 50% |

5. Conclusions and Future Works
This paper presented the development of a soccer games application using Kinect called the P-Soccer. P-Soccer focused on training for penalty kicks in soccer games by using the Kinect technology. P-Soccer introduces a new approach for interaction between users and the game characters. The interaction allows the game character to follow the body movement of the users. The main limitation in P-Soccer game design is the absence of goalkeeper. In real training, penalty kicks need the goalkeeper so the main character is able to learn the movement and how to respond accordingly. In addition to the goalkeeper, in the future, P-Soccer will be improved to allow the main character to change position when taking the penalty kick. This is to simulate in real training where players will determine their own distance to the goal post.

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