ADRS VIRTUAL REALITY CRICKET TRAINER

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ABSTRACT
Cricket is a widely played and watched sport all around the world. The ADRS Virtual Reality Cricket Trainer is a cricket trainer which provides batting practice for both amateur and professional batsmen. It can provide the user with a realistic cricket game experience while entertaining and also improving the batsman's batting skills. This cricket trainer will provide professional batsman real time practice against real bowlers in an environment very similar to the real world environment. It will also provide aspiring amateur cricketers with continuous practice to help improve skills and have fun. The batsman can practice alone, using little space without travelling to grounds and doesn't need to buy expensive cricket equipment. This is the ultimate dream product for Cricket lovers.

Key words: Virtual reality, Virtual ball, Real bat, Motion sensor, Image processing

1. INTRODUCTION

With the development of technology children grow up spending their time playing computer games, instead of playing real sports like cricket, baseball, tennis etc as hobbies. They tend to get addicted to video and computer games, which mean they are seated on a chair most of the time which leads to lack of exercise and health and fitness problems later on in life. The goal of the ADRS Virtual Cricket Trainer is to provide time, cost and space effective exercise and entertainment through playing Cricket which is a popularly played and watched sport around the world. The ADRS Virtual Reality Cricket Trainer is a cricket trainer exclusively to gain batting practice for both amateur and professional batsman with a feeling of reality and improve the batsman's batting skills as well as a source of great entertainment.

The ADRS Virtual Reality Cricket Trainer can be used by both professional batsmen to practice against real deliveries bowled by real bowlers around the world, on real pitch conditions, and also by amateur cricketers who can develop their batting skills alone without even stepping out of their houses. The batsman is able to interact with the game through a helmet with an LCD display on it and is able to face deliveries which are bowled by a virtual bowler.

The batsman (the user) has a cricket bat with a motion sensor on it to detect the angular movement of the bat, and the helmet and the bat uses an image processing technique which will detect the linear movements of the head and bat. The batsman can face up against a virtual ball whose dynamics (speed, direction and variation etc.) can be decided by the batsman, and is projected from the software and can play batting strokes according to the merit of the ball bowled. The feedback on whether the virtual ball hit the bat, if it hit then the calculated distance and speed that the ball travelled, can be viewed by the batsman.

The virtual environment for the Cricket ground, pitch and fielders is simulated. The batsman is able to select various grounds (which can change the bounce of the ball on the pitch, the amount of natural swing or spin and the speed of the outfield). It also has a wide range of functionalities and features which will help improve the batsman's skills.

Some of the advantages of the ADRS Virtual Cricket Trainer are:
- Practice in batting (amateurs and professional batsmen).
- Improve strengths, reduce weaknesses.
- Reduce cost of buying cricket equipment
- Reduce time spent travelling to grounds.
- Practice alone in a small space.
- Feeling of Reality (Interactive and Immersive).
- Simulate real strategies (fielding and bowling).

2. METHODOLOGY
2.1 Hardware

The minimum requirements needed to have the highest possible amount of reality, while playing cricket is as follows. Processor speed 4MHz, Hard disk space 10 GB, RAM 4GB, VGA with a video memory of 1GB. The Computer will be wired to the batsman's helmet (similar to a Head Mounted Display) using a 5 meter cable, so that the batsman can move about freely around the batting crease to play strokes naturally without being hampered. The helmet will be of plastic with framed covering with

the display fitted onto it. The display has a 7 inch diagonal, and will be fitted 15cm away from the batsman's face (minimum length to view clearly). A PCI Express VGA which has a Video out is used to convert the pc's VGA data to Video data for the display.

2.2 Method for Tracking Batsman's Head and Bat Position

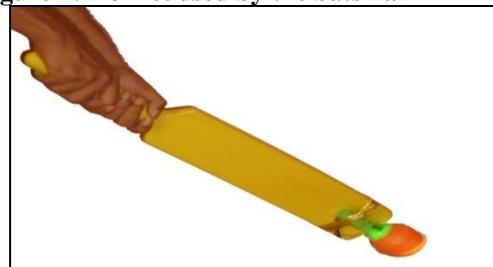**Figure 1: Helmet used by the batsman**

Figure 2: Bat used by the batsman

The bat position and head position capturing, which are essential to detect the batsman's movement in the game need to be captured. A combination of image processing technology and motion sensing technology is used to detect the batsman's head and bat movement. The head movement will be captured using image processing which is implemented by placing a web camera about 10 feet directly in front of the batsman. This web camera will capture the whole image of the batsman and filter the head by using color filtering where there is a red colored object with a light in it which will be filtered by the image processing algorithm which will filter the color (red) which has been used here, and show it as the white foreground in a black background. When the batsman moves his head this white foreground will also move accordingly and the movement will be passed into the XNA platform where the speed and position of the head movement obtained by the image processing application (emgucv) will be mapped with the game and the view of the batsman will change accordingly.

The linear movement of the bat also can be obtained in the same manner as stated above but a different color is used such as blue or green and a different algorithm is used to calculate the linear movement of the bat. The angular movement (rotation) of the bat around the X, Y and Z axis's is calculated by using a motion sensing device called the Wii Motion Plus [1], which provides high sensitivity and higher accuracy in detection.

The gyroscope inside the Wii Motion Plus is able to capture the rotation of the bat. To eliminate the additional movement because of the gravitational effect on the bat, a fusion algorithm is used and will help in providing more precision with the data received. This information of the rotation of the bat is passed into the XNA platform using Bluetooth technology and the rotation of the bat inside the game will be mapped according to the values obtained by this motion sensor. Using these technologies the movements of both the head and the bat have been calculated relatively successfully during the batsman's batting practice session in the batsman's batting space.

2.3 Software features

The environment developed, is very similar to a real world cricketing environment. The grounds and pavilions are modeled in terms of real world grounds in different countries around the world in looks and size. The pitches have similar bounce; the outfields have similar friction and bounce, and the wind, gravitational, Bernoulli forces which act on the ball while it's travelling through the air are also to be implemented similar to real world parameters.

The deliveries bowled at the batsman are very similar to the deliveries bowled by real world bowlers in variation, speed, line and length. If the batsman is a beginner he will be given much easier deliveries to play according to the skill level. There are many skill levels to pass before a batsman can move into the professional level, to face real world bowlers successfully.

The fielders are positioned according to real world fielding strategies and so the batsman can constantly improve placing his shots through vacant gaps, or over the fielders.

The method of getting runs and the amount of runs that a batsman gets in a particular session of practice, the amount and methods of dismissals his areas of scoring, strengths and weaknesses against different types of deliveries or against different types of bowlers or on different grounds are analyzed and stored in the database so that the batsman can analyze them later and come to a conclusion about his batting skill.

There are many features which help to analyze the batsman's game. The hawk eye [2] feature gives the speed and the trajectories that the deliveries bowled by the bowler will travel, so the batsman has an idea on the variations, speeds, lines and lengths bowled by each bowler. The Wagon wheel [3] feature gives the areas of the batsman's scoring so that the batsman can analyze his stronger and weaker scoring areas. The pitch map shows the position which the ball pitched and the result of that ball for the batsman, so the batsman will know

generally, the lines and lengths of the deliveries that he will either struggles against, as well as the ones against which he scores freely. The bee hive [4] feature shows the position of the ball at the point of contact with the bat, and the batsman can see whether he plays the ball too early or too late and how well he reads the bowler. The shot database records and shows the batsman's shots from many angles so that the batsman can analyze on how well the stroke was played to that particular delivery. The batting report gives the batsman a detailed analysis on each delivery the batsman has played, the stroke the batsman has offered each delivery, and how well the batsman has fared (runs scored) in facing each delivery.

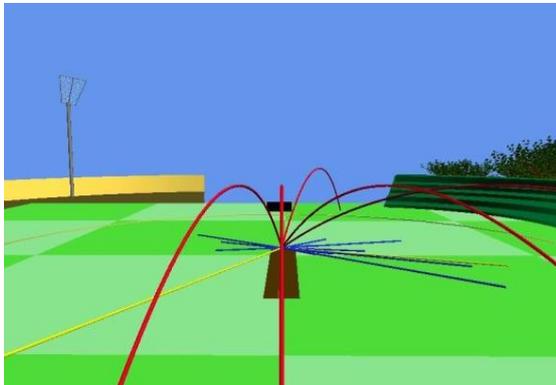## 3. RESULTS AND DISCUSSION

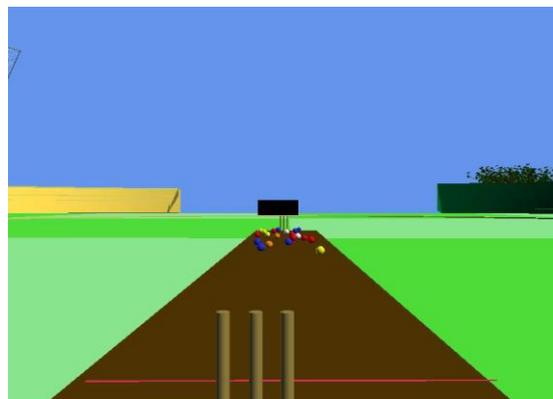**Figure 3: Hawk Eye**

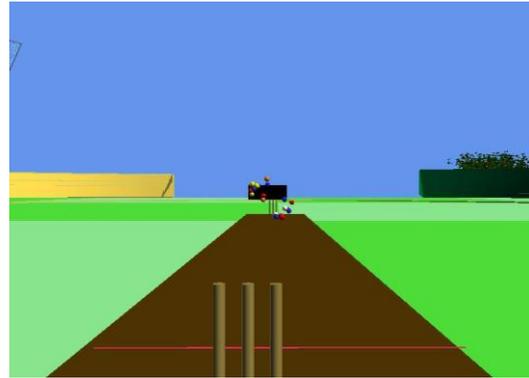**Figure 4: Wagon Wheel**

Figure 5: Pitch Map

Figure 6: Bee Hive
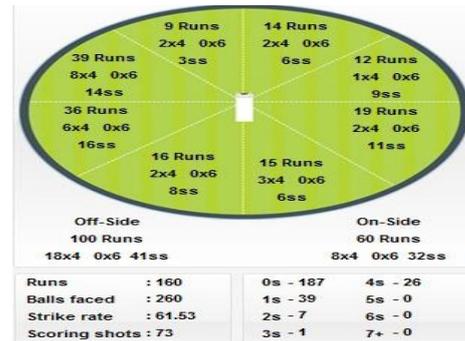

Figure 7: Shot database image

Figure 8: Batting chart

Figure. 3. shows the hawk eye feature which gives information like the speeds and the trajectories that the deliveries bowled by the bowler will travel.

Figure. 4. shows the Wagon wheel feature which gives the areas of the batsman's scoring.

Figure. 5. shows the pitch map which gives the position where the ball pitched and the result of that ball for the batsman.

Figure. 6. shows the bee hive feature which gives the position of the ball at the point of contact with the bat.

Figure. 7. shows the shot database feature which displays a replay of the batsman's shot.

Figure. 8. shows the batting scorecard feature which gives the areas in which the batsman has

scored runs, and analyzes the batsman's performance.

4. CONCLUSION

The goal of the ADRS Virtual Cricket Trainer is to provide batting practice for both amateur and professional cricketers and improve their batting skills. The trainer is definitely suitable for amateur batsmen to practice their skills against different types of low level (easy) bowling for entertainment purposes, exercise, and improvement in timing and placing the ball through gaps. But it is not yet suitable enough to provide batting practice for professional batsmen because the combined motion sensing technology is not sufficient to detect the linear and angular movements of the head and bat accurately. Apart from that using the many features such as hawk eye, wagon wheel, pitch map, bee hive, shot database, scoring sheet the batsman will be able to get a detailed analysis of the deliveries faced and the runs scored against them and the batsman's strengths and weaknesses.

5. REFERENCES

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