PROJECT SPECIFICATION - Project (Technical Computing) 2022/23

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| **Student:** | **Joe Kirkup** |
| **Date:** | **18/03/2023** |
| **Supervisor:** | **Mike Meredith** |
| **Degree Course:** | **Computer Science BSc** |
| **Title of Project:** | **Developing an app to assist in replacing the balls after a foul in a snooker match** |

#### Elaboration

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| In the game of snooker, when a foul and a miss is called, the player who the foul was committed against can request the referee to replace the balls to their position before the foul shot.  Currently, on the professional snooker tour, there is no technology in place to assist with this process. The verbal back-and-forth between referee and an offscreen assistant rewinding the TV cameras has, along the years, created many a drawn-out moment and instances of players disagreeing with the positions of the balls.  The need to replace the balls in a casual / club scenario presents even more of an issue, as there are no TV cameras to rewind. Players in these situations often resort to simply never putting the balls back as the positioning would effectively be a guess, thus missing out on part of the game.  The aim of this project is to create an application which greatly eases this process, and, importantly, removes subjectivity from the matter.  In an ideal world, given more knowledge about the relevant technologies and enough time, I would produce a software solution such that:  A smartphone with my app installed can be mounted, using a tripod or similar mechanism, to look at a snooker table with its camera. The system could also be configured to use an external camera feed such as an overhead camera, with professional use cases in mind.  While the game is played, the app tracks each shot individually, keeping score within each frame and detecting the end and winner of each frame.  The app also detects foul shots, and notifies the players of such. Then, either the mounted device or another device which is ‘joined’ to the game via the internet can be used to display an AR overlay of the correct positions of the balls on the table, giving a signal when all balls have been replaced correctly.  After either manual termination or a pre-set number of frames have been completed, the main mounted device and all ‘joined’ devices will display the score, frame scores and statistics such as pot success rate and average shot time.  Obviously I would not be able to develop this ‘dream system’ within the timeframe of the project. For that reason, I will be developing only part of the solution: detecting the positions of the balls after a shot, and assisting in replacing them.  To clarify the above development goals: Depending on time constraints, I will attempt to implement the AR overlay for replacing the balls, but this is a stretch goal if there is sufficient time after the core functionality is implemented. If a compromise seems necessary, I will instead implement a much simpler overhead view of the table in the app, with a confirmation if the balls are in the right place. I intend to implement the server-and-client functionality. |

#### Project Aims

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| Aims   * Develop a system that, using computer vision, indexes the position of every ball on a snooker table. * Create some form of initial output to digitally display the balls in their positions. * Extend the system to be able to store some number of shots until reset (by manual or automatic end-of-frame detection, or for some other reason) * Host a server on the main ‘watching’ device which can share the game’s data to other devices running the app. * Create advanced AR output to help replace the balls *(stretch goal)*   Objectives   * Research computer vision (detecting objects in frame, and straightening an abstract viewing angle given fixed points) * Build digital replica of a freeze-frame of an overhead view of a snooker table. * Detect and store each shot in a video of an overhead view of a snooker table. * Straighten an abstract viewing angle and apply existing code to create flexible solution. * Create a client-and-server connection between two or more devices. * Use the server to share game data. * Implement AR view mode for replacing the balls. |

#### Project deliverable(s)

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| I am going to produce a mobile application which, on one device, is configured to ‘watch’ the table and run a server or through some other means communicate with a client device, which can be used to help with the process of replacing the balls.  I plan to create a mobile application for Android; if compiling it as a cross-platform compatible app then I will also support iOS etc. but this is not a priority given my time and resource constraints.  In terms of engineering approaches, I will be targeting a scrum-style approach, using a Trello board and a GitHub repository throughout the project for tasks and tracking development of the deliverable, and holding short weekly meetings with my project supervisor to resolve any issues surrounding development. I will be making use of unit testing in my code where possible as I expect the codebase to be fairly complex. |

#### Action plan

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| |  |  | | --- | --- | | Find a supervisor. | 14th October 2022 | | Greenlight project idea. | 16th January 2023 | | Project Specification and Ethics Form | 26th January 2023 | | Initial research | 2nd February 2023 | | Information Review | 9th February 2023 | | Research computer vision and decide on technologies | 16th February 2023 | | Build digital replica of a freeze-frame of an overhead view of a snooker table. | 23rd February 2023 | | Create contents page. | 23rd February 2023 | | Detect and store each shot in a video of an overhead view of a snooker table. | 28th February 2023 | | Straighten an abstract viewing angle and apply existing code to create flexible solution. | 6th March 2023 | | Draft report and critical evaluation. | 9th March 2023 | | Create a client-and-server connection between two or more devices. | 13th March 2023 | | Use the server to share game data. | 16th March 2023 | | Implement AR view mode for replacing the balls. | 10th April 2023 | | Finalise report, evaluation and deliverable. | 20th April 2023 | | Project demo | 20th April 2023 – 4th May 2023 | |

#### BCS Code of Conduct

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| I confirm that I have successfully completed the BCS code of conduct on-line test with a mark of 70% or above. This is a condition of completing the Project (Technical Computing) module.  **Signature:** Joe Kirkup |

#### Publication of Work

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| I confirm that I understand the "Guidance on Publication Procedures" as described on the Bb site for the module.  **Signature:** Joe Kirkup |

#### GDPR

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| I confirm that I will use the "Participant Information Sheet" as a basis for any survey, questionnaire, or participant testing materials. The participant information sheet form is available on the Bb site for the module and as an appendix in the handbook.  **Signature:** Joe Kirkup |