**Designing and making judging aid for canoe slalom**

**CM3203 – One Semester Individual Project – 40 Credits**

**Final report**

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# Abstract

In most professional sports some form of video judge is being implemented. Cricket was one of the earliest sports to implement this technology with Hawk-eye back in 2001. With bowlers, bowling at around 90mph, it can be hard for TV spectators to follow the, but with Hawk-eye it allows the spectators and the umpires to replay these fast pasted moments to allow them to make better decisions on close calls.

Canoe slalom is no different. With athletes trying to reduce their times by seconds and cutting it as close as possible to the gates, a judge can only see so much from the bank. This project aims to design and make an accessible system for these canoe slalom judges to allow them to make better split decision calls. The project also aims to evaluate the success of the solution and verify if it could be scaled up and used in competitions at all levels.

# Acknowledgments

I would like to thank my supervisor, Dr Ian Cooper whose friendly advice and guidance throughout the whole project allowed me to work through the hurdles I encountered in the project.

I would also like to thank members of Seren Dwr Canoe club for allowing me to come down to their training sessions and collect data.

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# Introduction

As with any top level sport these races often come down to the finest margins, as such paddlers have been trying to find the smallest margins possible to help them win races. This has evolved over time with boat manufacturers using the lightest materials to paddle faster. In more recent years, manufacturers such as PeakUK have been developing garments such as the racer ST2020[[1]](#footnote-1)which take the vital buoyancy aid on the front of the paddler and integrate it into the spray deck, this allows for the paddlers chest to be unimpeded with the traditional buoyancy aid. Although these new designs only eliminate a few millimetres from the chest it allows the paddlers to get even closer to the poles. This new innovation meant that PeakUK athletes at the 2020 Tokyo Olympics were able to win a total of 9 out of the 12 possible medals[[2]](#footnote-2).

With the margins being as thin as mentioned above, the pressure that the judges are under to make accurate calls are huge, especially when a penalty means the difference between 3rd and 4th place, as with the Olympic games this summer[[3]](#footnote-3). That is why, my project aims to create a product that will aid judges in making these split decision calls while the race is still going, without necessarily using a video judge.

Although the project is aimed for the judges use at the most competitive levels of sport, it could also be used as a training tool for all the athletes in the sport. At a canoe slalom coach is having to perform two job, one as a judge making sure their paddler makes it through the gates and secondly as a coach to see what the paddler can improve on. If my project was used, the role of the judge can be taken away and the coach can focus on coaching. The coach will also be able to gain more data for quantitative feedback from the various sensors and outputs on the poles.

As of the 2018 season, the ICF (international canoe federation) has brought in a new system for video judging for only the world cups and the world championships[[4]](#footnote-4). Compared to tennis or cricket who have been using video judging since 2001. Even then in canoe slalom there is a very large team of judges, some watching the live video feed of the run and some reviewing the replay of any contested decision. Whereas in a sport such as rugby, there is only one video judge who runs it all. My proposed project would utilise the judges already on the river bank. These judges would first watch the paddler come through the gates and if they then decided there is a close call they can refer to the mobile device which will have a data for them to review instantly. All of this will reduce the pressure on the judges, reduce the number of judges needed, and cut down on the time taken to the review close calls.

# Background

## A beginners guide to canoe slalom

The main focus of this project isn’t to teach the reader about the intricacies of canoe slalom, an understanding of this sport is useful to fully understand the project. A full list of canoe slalom terminology can be found in the appendix.

In canoe slalom athletes race down a roughly 200 meter long course consisting of a minimum of 18 and maximum of 25 different gates, of which 6 must be upstream gates. Paddlers can occur time penalties of 2 seconds for having a touch on the poles, this can be from any part of the paddlers body, or any of their equipment. The athlete can also gain a 50 second penalty for not having their complete head go in between the two poles, or for navigating the course in the wrong direction or order.

The way this is judged is with two judges having a set of 4-5 gates between the two of them. They will watch the paddler head down the course and report back to the race control what the results are. This will be in the form of numbers, for example a “zero, zero, 50, two” means that the paddler has successfully navigated the first two gates, missed the third gate, and touched the fourth gate. At the top level of the sport, if there is a disagreement between the two judges or they aren’t sure on what to give they might be able ask the video judge to review the footage they have.

* 1. Current implementations

A picture containing text, outdoor

Description automatically generatedOn a typical canoe slalom broadcast such as the Olympics or the world cups we never get to see any of the judging or video judging taking place. The viewer might get some slow motion replays of the gates if there is time between each paddler, but there is never any formal type of judging shown. The only aid that the viewer has is a small icon showing if the paddler has hit or missed the gate.

Figure 1 – Typical canoe slalom world cup broadcast, with icon showing penalties

* 1. Tools used

### Flask

The first and arguably the most important tool I used was Flask. This is a popular web app framework for python. I decide to use Flask over other frameworks such as Django as I already had some experience with using Flask in other project. Flask is also lighter weight which was important for me as everything would be running of a raspberry pi, which are notorious for struggling to run programmes.

Flask was able to provide the basic functionality to get everything the canoe slalom judge would need onto a web app. This was a vital criteria for the project, without the use of a web app the judges would need a lot more training on the programme to be able to use it effectively. Flask also has different protocols which have been very useful when building the programme. The most common request I have been using has been the GET request allowing me to get data from the flask server, this can be anything as simple as a flask route or html template.

### SQLite

### MatPlotLib

### Camera

# Approach

# Implementation

# Results and evaluation

# Future work

# Conclusions

# Reflection on learning

# Appendix

## Code

## Glossary of Canoe Slalom terms

**Downstream –** The direction the water is flowing

**Upstream** – the opposite direction that the water is flowing

**River left –** The left hand side of the river, if you are looking at it downstream

**River right –** The right hand side of the river, if you are looking at it downstream

# References

1. https://peakuk.com/index.php?route=blog/blog&blog\_id=283 [↑](#footnote-ref-1)
2. https://peakuk.com/index.php?route=blog/blog&blog\_id=340 [↑](#footnote-ref-2)
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