# Meeting Minutes

## ▼ 30/09/22

Meeting begin 12.30

Introduced ourselves, and discussed the project. The aim is to work together first define the rules of the competition, then create a website to promote it. Finally we work individually and put our own entry into the comp.

Key parts of the competition were discussed, such as:

- people from all over the world should be able to enter and the track should be easily reproducible
- will most likely be a closed robot competition due to the fact reproducibility is a key aspect.
- it is up to Lewis and Hank to decided what the competition would involve

Our entries should build off of what the student (Kirsten) developed the previous year.

Jonathan stated that he'd like to receive an update from us every week, about what we've done the past week, at least 24 hours before the next meeting.

> 💡 Decided our first goal would be to do our own research on self-driving robot competitions. Jonathan provided us with some links and also gave Lewis the model robot to have for the week.

Meeting ended 13.05

## ▼ 07/10/22

Meeting begin 12.40

Discussed the research that Lewis and Hank had conducted. Amazon Deepracer was one both students had looked at.

Lewis brought up various key points and questions found during his research.

- was discussed that the robot does have the ability to both turn and move forward at the same time, however the code on the robot would need to be

changed.

- the competition is simply a proof of concept, there should not be an expectation that many people will enter.
- race courses found from other competitions are generally large and complex, however the one created for this project will have to be small and simple due to having to be built in peoples homes.
- brought up possibility of the robot navigating a maze for the competition, however this was decided to be too difficult to reproduce.
- how the track is built is important - it should be built with easily accessible items.

It was decided it would be good to have multiple parts of the competition - some which the robot was guided by the controller and others where the robot is self-guided. A good way to do this is to keep the same track during the competition but make it incrementally harder.

- first navigate simple track with controller
- second navigate track with obstacles with controller
- third navigate simple track with yellow line for robot to follow
- fourth navigate track with obstacles

Another key point which was reiterated was to make it easy for people to share their work.

> 💡 It was decided Lewis and Hank should start working together to create a brief outline of what the website could look like and how it could be built. They should also get some rules written about the competition.

Meeting ended 13.10

## ▼ 14/10/22

Meeting start 12.35

Discussed our refined ideas for what the track would look like. Lewis suggested removing some of the simpler tracks (the tracks where the robot travels in a straight line) however this was decided against as the competition wants to start

off really easy as many people who will enter will not be experienced with self-driving robots.

Hank brought up the idea of introducing a track with a parking zone - Jonathan agreed this was a good idea.

Lewis and Hank asked for clarification on a round suggested by Jonathan during the week. Jonathan clarified that a good round could be to have a round which the robot follows a path drawn by a user on their phone.

Lewis and Hank said they had decided upon some basic rules of the competition:

- each round in the competition will be ranked by the fastest time to complete the track. Each round will have a leaderboard and then there can be an overall leaderboard to show which contestant is doing the best across all the rounds.
- robots which go slightly off the track will have a time penalty added to their time and robots which go completely off the track will be disqualified
- the best time out of 3 attempts will be taken.

Lewis asked what is the best way to measure the time it takes a robot to complete the track - Jonathan suggested that simply using a stopclock is accurate enough.

Lewis asked if the code for each entry will be judged - Jonathan suggested that it shouldn't be.

Lewis showed Jonathan the start of the design of the website he had created during the past week. Jonathan agreed the simplistic design looked nice and stated the website didn't need to be complex and it could be built using Github pages.

> 💡 It was decided Lewis and Hank will continue to refine their Figma design. They would also create an organisation on Github for the shared repository and also further refine the practicalities on how the race track can be built.

Meeting ended 13.03

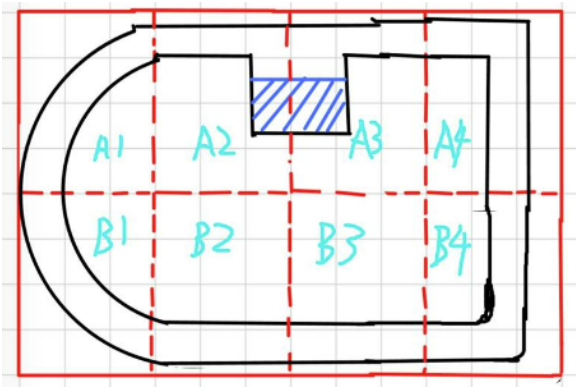
## ▼ 21/10/22

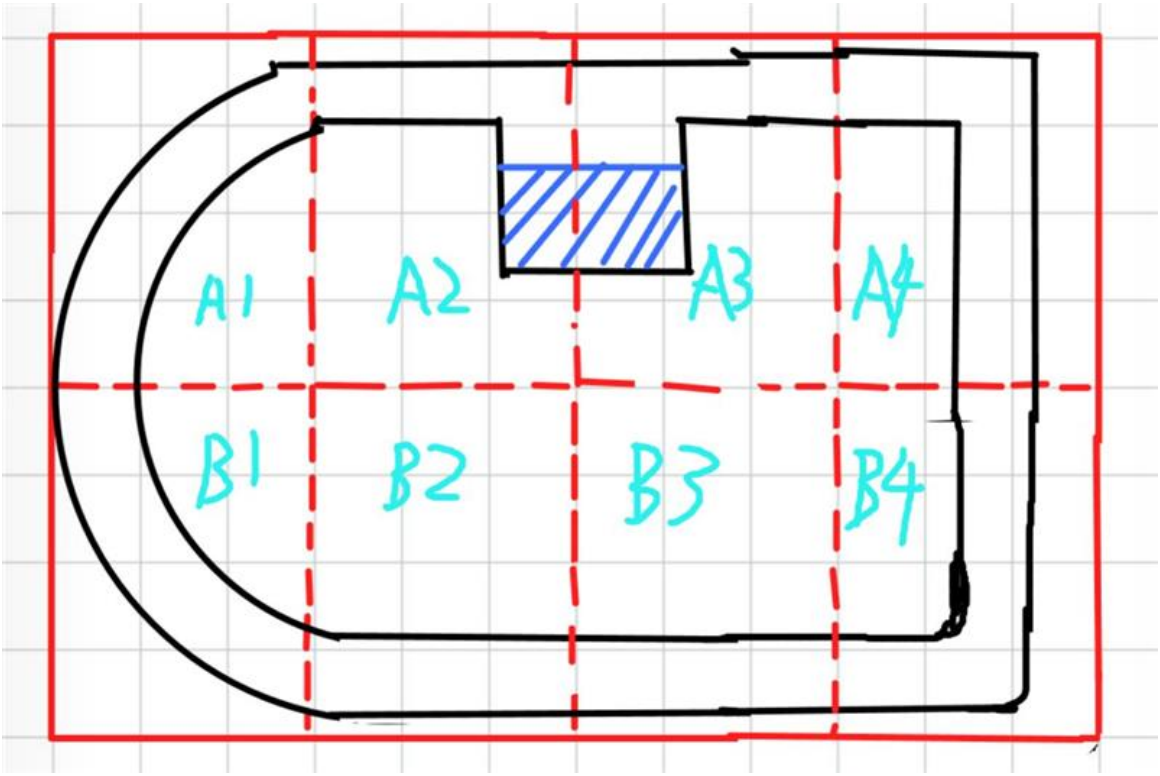
Meeting start 12.30 (on Teams).

Lewis and Hank discussed with Jonathan their refined idea for what each round of the competition would look like <link below>

Hank proposed an idea as to how to build the track:

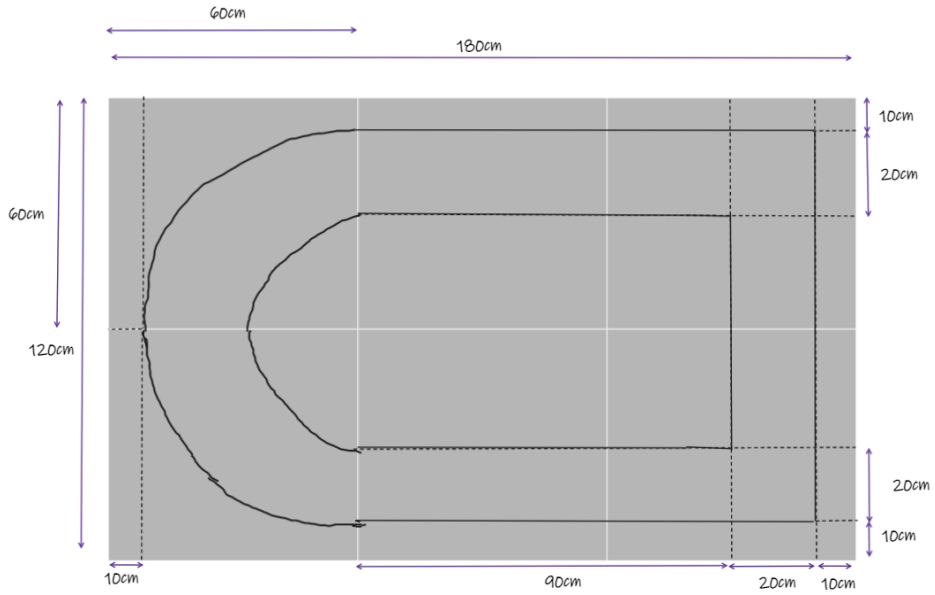
For people who want to rebuild the track in the home, the race track can be divided into several A4 papers. Each part can be labelled eg. A1, A2, A3 etc and make the photocopy. After that, the file will be uploaded for people to download. The participant can use tape to connect the back page so they can easily rebuild the track.



For the formal race track which will be used to test people's submissions,  EVA foam interlocking tiles for the floor can be used.

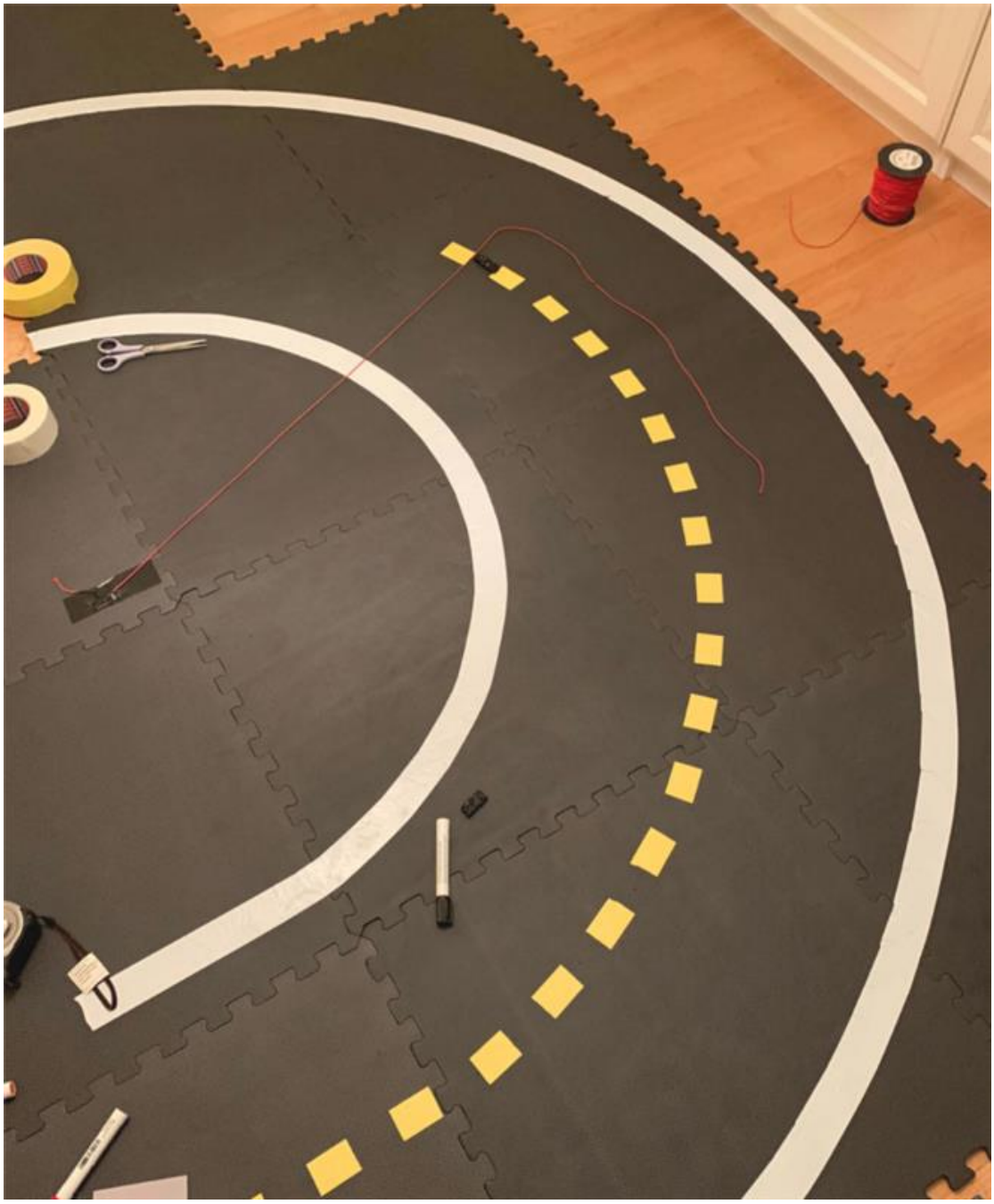
Lewis then showed some measurements proposed.




Jonathan agreed the tracks looked good.

Lewis and Hank asked Jonathan how can the robot know which direction to turn when it's in the parking zone. Jonathan found a solution by sending a link which describes QR codes with directional properties which the robot can scan to know where to move.

It was dicussed Lewis and Hank will finish the Figma design and get a rough skeletal structure of the website created. They will also think of a name of the competition and start building the track and test the qr code. They will also write up more formally the rules of the track



Meeting end 12.50

## ▼ 28/10/22

Meeting start 12.37

Hank showed the potential track he had printed across 8 sheets of A4 paper. It was discussed that this was too small for the robot and the track should be re-printed across the size of an A0 sheet (16 sheets of A4).

It was also discussed the track should be drawn using a professional drawing software - an example mentioned was Figma.

Lewis showed design of website and went through the rules of the competition - there were no issues.

Discussed how the data for a user would be entered into the website - it was decided that this could be done by hand since there would be very few entries.

Went over the application page - Jonathan suggested that this should instead by done using a link to a Google form, as this would save a lot of time coding. The code could also be submitted by asking the entrant to submit a link to a Github where they keep their code.

It was decided that the main focus should be on getting a professional standard track printed, as pictures and videos of this would be needed for the website.

It was mentioned that ideally the website would be finished by mid November.

Lewis gave the robot to Jonathan to try and fix as everyone was currently not able to connect to the robot.

Lewis to keep working on the website + create google form.

Hank to redesign track using professional software across the size of A0 paper.

Meeting end 12.55

## ▼ 04/11/22

Meeting start 12.30

Jonathan gave working robot back to Hank - did not know the issue that caused it not to work last week.

Hank showed the track he had made on Figma and the robot was tested on part of the track. Jonathan suggested some improvements to make.

- The boundary line and the dashed line might be too thin for the robot to follow - we should test this to make sure it works
- Should redo the curved dashed line using a drawing tool (not hand-drawn)
- For boundaries which cross the track, make them a different colour
- Make it clear the boundary for the parking zone
- Get version of the track annotated with dimensions
- Add the QR code for parking to the

Jonathan suggested using software such as Onshape or AutoCAD.

Lewis showed live version of website to Jonathan - Lewis remarked there are still improvements to make which will be made over time.

Lewis showed the Google form created for people to apply. Jonathan suggested that instead of asking the applicant to upload a zip file for the videos, instead a youtube playlist could be created for people to upload their videos to.

Looked at the link https://www.formulapi.com/ - this contains good examples of a race track for self-driving robots and can be referred to.

Looked into different materials to put over the racetrack - some examples were:

https://www.vistaprint.co.uk/signs-posters/banners/fabric-banners
https://www.liquidimaging.co.uk/largeformatposters_academic_fabric_posters.asp

Agreed that this week we should focus on assignments for other courses.

- Hank is to make improvements to the track as suggested above
- Lewis to keep working on website

Next week, we can start looking at developing the robot.

Meeting end 12.50

## ▼ 11/11/22

Meeting start 12.33

Lewis went over demo of website - only main things left to do is create the “Built it Yourself” page and get images of the track on the website.

Hank showed the diagram of the track with dimensions on.

Task for both Lewis and Hank is to meet with Callum next week to help get a start using his tools on developing the robot.

Additionally to pick up the puck from Jonathan during Monday.

Meeting end 12.43

## ▼ 18/11/22

Meeting start 12.30

Discussed meeting Lewis and Hank had with Callum. They had implemented basic functions of the puck following Callums tutorial and also set-up a peer connection to connect a host laptop to a phone camera.

Jonathan brought up problem of how a move() function can be implemented - thought should be put into the various different ways this can be done.

Current 3d printed robot is not working, so discussed idea of finding some other way to practice our code: either getting another robot or using an online simulator.

Tasks for Lewis and Hank:

- pick up robot from Callum
- try to implement a move function on the robot, considering what parameters could be used and different methods of implementing it.

Meeting end 12.50

## ▼ 25/11/22 - Missing

## ▼ 02/12/22 - Missing

## ▼ 07/12/22 - Missing

## ▼ 16/01/23

Meeting start - 11.50

The meeting started by briefly discussing progress made over the holidays by both Lewis and Hank.

Hank started by demoing his joystick controller. This had responsive control, but after a couple of seconds was difficult to control.

Lewis demoed his joystick controller. This could be used for long periods, however had a noticeable delay, making it difficult to use. Lewis mainly demoed his UI, which had been styled to work on a mobile device.

Jonathan suggested a good goal to have for the next week would be to improve the joystick controllers so that they would be able to navigate the robot around a water-bottle placed on the floor.

Meeting end - 12.15

## ▼ 23/01/23

Meeting start 12.00

Lewis demoed his joystick controller - this included the ability to now dynamically change the speed at which code is sent to the robot. Additionally, a diagnostic button was included to test that the robot can still move in the correct direction for a set of angles.

However, still prevalent in the controller is that code could not be sent faster than 600ms. Jonathan mentioned how this can be a big issue. Therefore, he suggested I join his and Callums meeting in a few days to discuss ways to mitigate this issue.

Hank also demoed his joystick controller - this had no delay, however after a couple seconds of use, instructions piled up causing a backlog.

Both joystick controllers struggled to perform a simple task such as navigate around a water-bottle. Therefore, it was strongly suggested to improve the controllers.

Meeting end - 12.15

## ▼ 25/01/23

Meeting start - 14.00

The meeting started by discussing the problem which Lewis is experiencing. This is that the maximum speed at which he can send instructions to the robot is ~600ms. This number was found via testing - any number below this starts to cause backlogs when processing instructions.

Callum suggested the possibility of an issue on his side - perhaps in some wait times implemented in the espruino-tools core package.

Other possible factors were discussed such as the code on the pixl.js and the buffer.

Lewis agreed that he would implement a minimal example joystick for Callum to perform testing on.

Lewis then left the meeting while Jonathan and Callum continued.

Meeting end - 14.20

## ▼ 30/01/23

Meeting start - 12.00

Lewis remarked that originally he had demo to show where the robot had no delay when processing instructions. However, the delay had returned moments before the meeting. Therefore there was no demo to show.

Hank demoed his joystick controller.

Jonathan suggested moving on to self-driving features as it would be useful for the project to be able to demo robot being controlled by some form of vision methods.

Lewis suggested that the next week be spent investigating the feasibility of implemented different self-driving methods, such as colour-tracking, or line-following.

Lewis also showed the annotated version of the track that he had designed over the Christmas period. However, he said that before it could be printed, he would first need to know which colours would work best for colour-detection, and how thick lines would need to be to be detected.

Meeting end - 12.20

## ▼ 08/02/23

Meeting start - 14.40

Lewis started meeting by demoing all the new features added to the self-driving page. Such features discussed were:

- colour tracking - however this struggles to identify many colours other than black and green
- colour space conversion - an attempt was made to implement this, so that it could supplement colour tracking feature. However it was abandoned due to difficulty and time constraints.

- line-tracking - very basic line tracking was implemented
- grey-scale conversion - this had been implemented
- aruco marker detection - this had been implemented

A main point of discussion was how any of these features could be used to aid the robot in autonomously driving. Lewis expressed his concern regarding time constraints, therefore any new features would have to be limited in scope.

Jonathan therefore suggested, abandoning the colour tracking, colour-space conversion, line-tracking, and the track altogether, and instead suggested focusing on a feature involving the aruco marker which would allow the robot to follow the central point of a phone camera.

Lewis agreed that this would be feasible within the time constraints.

Lewis briefly mentioned the dissertation and asked Jonathan if there should be a research question. Jonathan said that a research question is not necessary since this isn't a research project. Instead, it would be more useful on focusing on project aims.

Callum joined the meeting. Lewis mentioned delay in instruction speed being sent to robot. However, it was discussed that this wasn't a big issue and would not be worth spending more time attempting to fix issue.

Meeting end - 15.10

## ▼ 27/02/23

Meeting start - 12.25

Lewis showed Jonathan his demo of the 'Virtual Lead' feature. The following points were discussed between the two:

- the feature could not be used using a low resolution camera - such as ones commonly used on an Android device. Therefore, an IPhone was used for the demo
- to connect to the peer device, the host and peer must be on the same public network - such as a hotspot.
- different methods were tried in-order to implement the feature. At the moment a qr-code is used for this feature. However both qr-codes and aruco markers

can be used.

- it can be difficult to control the robot as the camera feed is not displayed on the mobile phone - instead only showing on the laptop.
- the feature is still currently needing improvements, such as changes to instructions speeds and frame rates.

Jonathan suggested altering feature slightly so that robot instead navigates to central vertical line, rotates to face forward, then move towards.

Lewis and Jonathan then briefly discussed progress on dissertation and progress plan for coming weeks. This included having a first draft to look over before the final deadline.

Lewis then went over his development process for the project. This included:

- minuting of meetings
- how issues were tracked and current issues
- how the project is deployed manually but possibility to implement pipeline if time constraints allow.
- other miscellaneous work done between meetings.
- why typescript was chosen as development language

Finally, the meeting concluded by evaluating the prototype for the new robot.

Meeting end - 13.15

## ▼ 06/03/23 - Missing

## ▼ 13/03/23 - Missing

## ▼ 20/03/23

Meeting start: 12.25

Whole meeting was spent going over the dissertation. Lewis showed Jonathan each chapter of the dissertation, commenting on what he had done.

Lewis went through introduction. Jonathan remarked upon some small mistakes, such as a mistake regarding Lewis’s description of how UART is used.

Lewis remarked that the only section left to do is the evaluation and conclusion. Jonathan asked how the evaluation had gone and Lewis said that he had gotten 10 participants and had gotten them to complete a questionnaire.

Both agreed that for next meeting, Lewis should have almost all the dissertation finished and they can go through a plan for the presentation.

Meeting end 13.00

## ▼ 27/03/23

Meeting start 12.10

Meeting was spent going over dissertation.

Lewis remarked he still had to finish the final part of the dissertation, however he was almost there.

Jonathan comments on small features of the dissertation (such as noticing figures which still had to be placed), but otherwise said it all looked good. One change which he suggested was changing the wording for one of the controller aims - specifically, the “web based” one.

Additionally, both discussed plans for the presentation, Jonathan said to be careful as 12 minutes is not long for the presentation.

Meeting end 12.40