# Testing and Evaluation Plan — Group Bernie

Participants will control the Go2 Edu robotic dog, Bernie, in a simulated search mission within a classroom arranged as a grid in two separate tests; by mapping movement from the Virtuix platform, and by using only joystick controllers, while observing the environment through a VR headset. Half of the group of participants will complete Test A on the platform and Test B using controllers, and vice versa for the other half.

- **Environment:** The room is configured into a grid with 7 vertical corridors (columns) and 5 horizontal rows, measuring 13 m in width and 9.5 m in height.

- **Starting/Finishing Point:** The room's door (marked with a blue circle labelled `Base`) is the designated start and finish location.

- **Hidden People:** Five hidden people (HP) are placed at predetermined grid positions, which are unknown to the test participant (see the Map Key below), with two idle corridors where no HP are to be found. By locating these HPs, Bernie has 'searched'. By receiving a response from the HP and providing aid (first aid kit, mobile phone, water), it has 'rescued', to the extent a robotic dog can do so.

- **Time Limit:** Each trial is limited to 20 minutes.

- **Control Methods:** Two interfaces (a Virtuix platform and joystick controllers) will be compared during separate tests. HPs will be different for test A and test B so that the user doesn't have existing knowledge of their locations.

- **Objective:** Navigate the grid to locate as many hidden people as possible and return to base as quickly as possible. Users will get an accuracy score out of 5 as well as a time score.

- **Evaluation:** Alongside numerical scores, participants will take questionnaires after both tests to comment on their user experience, including level of tiredness and motion sickness for both qualitative and quantitative measure.

## Map Key

- **Corridors:** The room is divided vertically into 7 corridors. The x-axis spans 0 m to 13 m, with corridor centers located at 0.5, 2.5, 4.5, 6.5, 8.5, 10.5, and 12.5 m. Corridors are walled by tables, which are shaded in blue.

- **Rows:** The room is divided horizontally into 5 rows (each 1.9 m tall). The row centers are at 0.95, 2.85, 4.75, 6.65, and 8.55 m, in which the HP are placed.

- **Hidden People (HP):** Represented by red circles at positions which sum to equal the longest possible Euclidean distances for both tests.
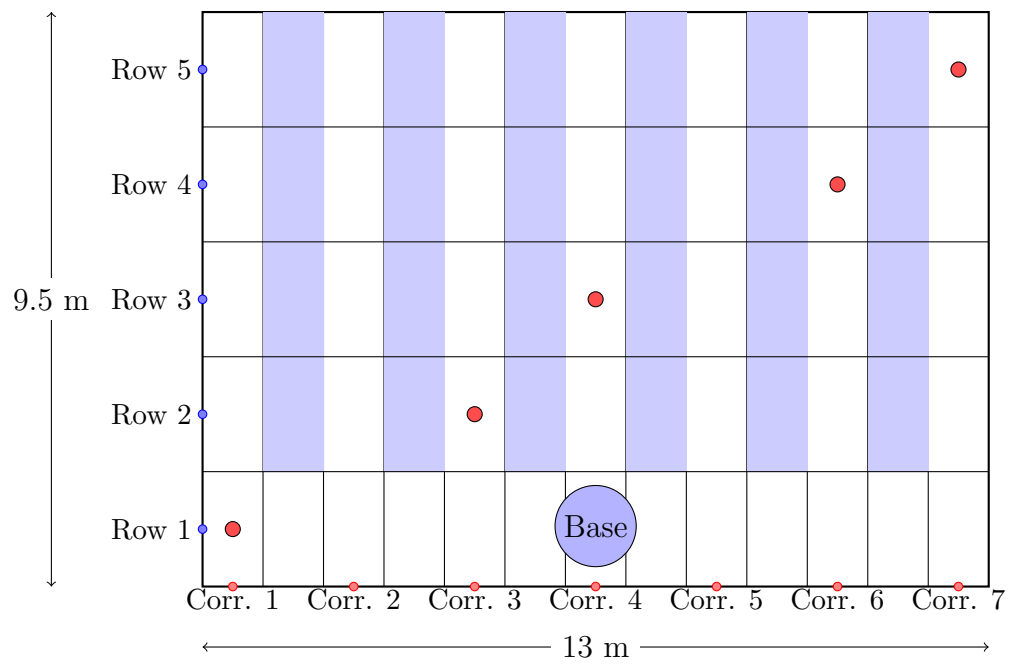
**Test A**
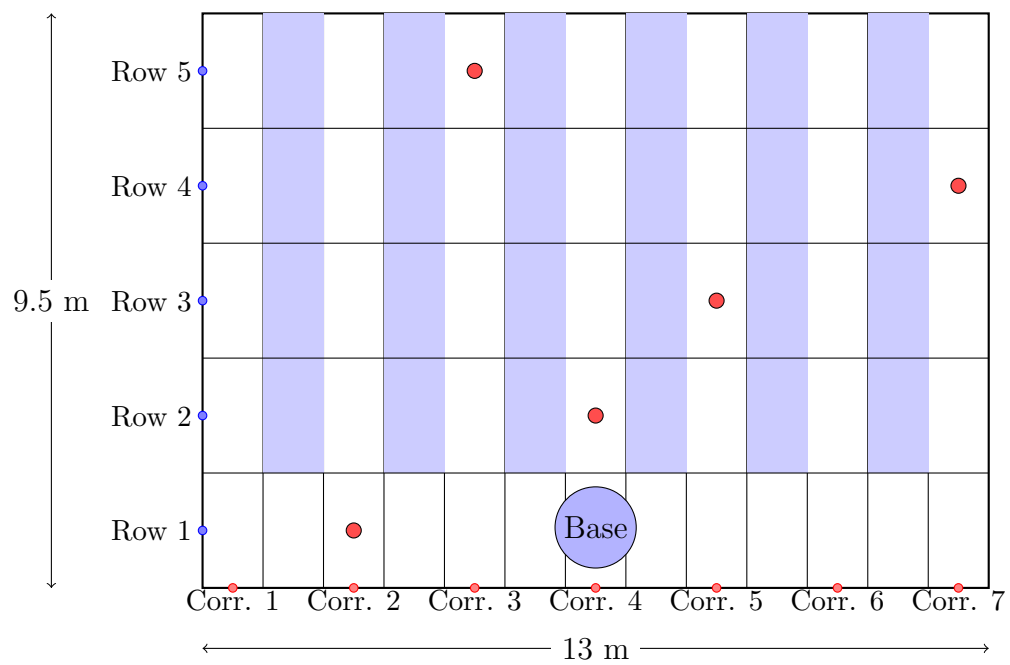


**Test B**

## Practicalities

Items needed:

- Masking tape so ensure HPs location is consistent through all tests, as well as table edges and Base line.

- Cones to outline baseline clearly for the user.

- Stopwatch to time course completion.

- Room bookings to ensure enough time allowed for set-up and uninterrupted test completion.

## Timetable

All tests will be carried out in the lecture room EE403a/b, and will require 8 participants.

Every participant will have to fulfill two tests, one using the Virtuix platform for navigation and the other using the handheld controllers. To get significant results from the experiment, the participants will be split into two groups. Participants one to four will start with the Virtuix platform, whereas participants five to eight will start with the handheld controllers. To make the testing as fair as possible, two different scenarios will be set up, Test A and Test B, as discussed above in the Map Key section.

Each participant is given 10 minutes to get familiar with the navigation system, and then the actual test will start shortly after. The participant will be given 20 minutes to complete the tasks, but will also be timed to see whether the Virtuix not only increases cognitive offloading, but also increases task completion time.

The timing of tests is roughly planned below in Table 1. Another potential day for testing is Friday 7th March 10:00-14:00 and 16:00-18:00, if integration is finalised by then.

|  | Tuesday 18/03 | Wednesday 19/03 |
|---|---|---|
| 12:00 - 12:30 | Setup | Setup |
| 12:30 - 12:45 | Setup | Setup |
| 12:45 - 13:15 | Setup | Person 6 train and test B (Handheld controller) |
| 13:15 - 13:30 | Setup | Person 6 questionnaire |
| 13:30 - 14:00 | Person 1 train and test A (Handheld controller) | Person 1 train and test B (Virtuix) |
| 14:00 - 14:15 | Person 1 questionnaire | Person 1 questionnaire |

| | | |
|---|---|---|
| 14:15 - 14:45 | Person 2 train and test A (Handheld controller) | Person 2 train and test B (Virtuix) |
| 14:45 - 15:00 | Person 2 questionnaire | Person 2 questionnaire |
| 15:00 - 15:30 | Person 3 train and test B (Handheld controller) | Person 3 train and test B (Virtuix) |
| 15:30 - 15:45 | Person 3 questionnaire | Person 3 questionnaire |
| 15:45 - 16:15 | Person 4 train and test B (Handheld controller) | Person 4 train and test B (Virtuix) |
| 16:15 - 16:30 | Person 4 questionnaire | Person 4 questionnaire |
| 16:30 - 17:00 | Person 5 train and test B (Handheld controller) | Pack up |
| 17:00 - 17:15 | Person 5 questionnaire | |
| 17:15 - 17:45 | Pack up | |

Table 1: Testing timetable

## Questionnaires

Each participant will be given the Trust Perception Scale - Human Robot Interaction (HRI) questionnaire based on `https://link.springer.com/chapter/10.1007/978-1-4899-7668-0_10` to fill out before their test to see if they have any previous experience with robots, and after their test to assess trust of the robotic system. The Trust Perception Scale - HRI questionnaire will also be given before the test to note whether the participant has any previous experience with robots. The NASA Task Load Index(TLX) `https://humansystems.arc.nasa.gov/groups/tlx/downloads/TLXScale.pdf` and Augmented Reality Immersion (ARI) `https://www.sciencedirect.com/science/article/abs/pii/S1071581916301306?via%3Dihub` questionnaires will be given to the participants after their tests to assess strain on the operator as well as measure perceived immersion.