My project is called CogniDriver and it is a 3D mind-controlled car-driving game. The aim of the project was to use the electroencephalograph technology as a different way to control a game.

For developing the game, I have been using the developer’s SDK which comes with the Emotiv EPOC headset and the Unity game engine (used to develop games such as assassin’s creed identity, nfs world, Battlestar galactica online). The headset is composed of 14 sensors which transmit raw EEG data from the brain to the computer and it then gets interpreted and we are given access to those interpretations. It consists of 4 suites: facial expressions, emotions (excitement, engagement/boredom, frustration, meditation), Cognitiv (13 states) and gyroscope data. Before using the headset, the sensors need to be well hydrated with saline solution in order to obtain best data transmission. The sensor contact quality is appearing on all of the scenes of the game, together with the current action being executed and the power of that action. The player’s aim is to try and reach the finish point in as short a period of time as possible while also collecting as many road coins as possible. Road coins have been suggested as a feature during the user testing in week 4 and it has the benefit of both letting you know the right way of going and also making you stick more to the middle of the road. It can be seen in a similar way as a mission in GTA for example where the aim is to collect points rather than to a specific action at a certain destination.

CogniDriver has 3 playing modes: Keyboard, Cognitiv and Gyro. The Gyro is currently under development due to some inaccuracies and it might not be feasible as a way to control the game because the player would have to remove eyes from the screen.

I am firstly going to demonstrate the Keyboard play mode. The user will firstly need to select a car model and colour. Carole, what is your favourite colour? Apart from the arrow keys and w,a,s,d to control the car movement, the user can use ‘C’ to change the camera view, spacebar to apply a handbrake to the car, ‘P’ to pause the game, ‘R’ to restart the current game play and ‘T’ to put you back on the road to the last checkpoint. The road track has been created using the EasyRoads plugin available in the Unity asset store. On the road, I have place 17 checkpoints through which the user will have to pass so that the final score is recorded. In the unlucky case in which they try to cheat by reaching the end point through different methods, a sorry message will be displayed.

In Cognitiv mode, the user can do a left wink to change the camera view and clench teeth to apply handbrakes. The moment a user’s frustration levels get high and their excitement level is low, a rain effect will occur in the game. This has been created as a particle system.

Training occurs in sessions of 8 seconds. First time a user will have to train all states in order to gain access to the animations and action recognition as recognised by the headset. A skill level is shown to tell how well a user can execute a certain command such as push/pull/left/right. Complete training process for all 4 actions can depend on how easy it is for a person to switch to a certain state and how easy it is for them to maintain that state. I would approximate about an hour for a full training process.

During week 4, a group of 13 testers have tried playing the game in both Cognitiv and Keyboard mode. Their suggestions were taken into account and the most visible additions were:

* Road checkpoints (17);
* Coins on the road to make users stick to the road and provide an additional aim for the game as well as a new way to select the highscores and lets you know which side of the road is the right direction of driving.
* Using a car model instead of a cube for the Cognitiv training process;
* Different speeds for each car on the road and on the grass.
* Replacement of current action text with arrows to indicate it visually.

The participants to the test have also completed 2 NASA TLX (Task Load Index) questionnaires which suggested that on average a 52% has been achieved for Keyboard play mode and 91% for Cognitiv which shows the users have found it significantly difficult to control the game using the headset but with the mention that if they had used it more, it would probably be as easy as using a keyboard, if not more natural. Some of the observed challenges were users overriding the previous training by not managing to get in a state significantly different to the previous one; also, once the car was observed moving, the level of enthusiasm would make some drop concentration.

This is a video of one the testers achieving quite a beautiful left turn on the first turn of the road.

Known bugs so far:

- Delete/Create profile bug

The game is playable on Windows, Linux and Mac operating systems.