# Reverse Parallel Parking Car Challenges

In your presentation you will be required to discuss how you went about developing an autonomous parallel parking car prototype. You should **not** make any reference to the challenges in your presentation. Your presentation should link the skills, techniques and knowledge gained through the challenges to the final goal. You will need to clearly link each skill (e.g. turning the ultrasonic sensor in challenge 2) with its role in the prototype (the need to be able to look forward to avoid crashing into cars in front and left to detect parking spots).

### Challenge 0: Hello world!

* Build your car and have it checked for roadworthiness

## Challenge 1: All steam ahead

* Make your car drive forward in a straight line, after travelling at least 50cm (does not need to be exact), steer to the right until you are at least perpendicular to your original orientation then stop all movement

## Challenge 2: I can see clearly now…

* Control your ultrasonic sensor motor so that the sensor points forward for 2 seconds, left for 2 seconds and then repeats these two steps a total of four times.
* *The first two groups in each class to achieve this wins a jelly cup for each team member*

## Challenge 3: Going the distance

* Your ultrasonic sensor should point forward and the robot should move slowly forward in a straight line. If the ultrasonic sensor detects an obstacle within 20cm it should stop and play a sound.

## Challenge 4: Let there be light!

* Place your robot on the highway so that the light sensor is above the black road surface. Put your light sensor in active mode. Your robot should stop as soon as it encounters a white line and play two beeping sounds.

## Challenge 5: On the road to nowhere

* Place your robot on the highway. Use your light sensor in active mode to guide the robot so it stays within its lane on the highway. The wheels must not cross the white lane markers
* *The first group in each class to complete this challenge will be awarded the use of the Bluetooth dongle for 3 weeks*

## Challenge 6: Dibs that spot!

* Your robot should travel along the highway with its ultrasonic sensor pointing left. Once the robot detects the start of a parking spot it should stop all movement and play a beep
* *The first group in each class to complete this challenge will be awarded a victory flag*

## Challenge 7: Beep beep beep…

* Your robot should travel along the highway with its ultrasonic sensor pointing left. Once the robot detects the start of a parking spot it should then continue along until the end of the parking spot. After reaching the end of the parking spot it should continue to move forward until the rear wheels are in line with the end of the spot. The length of the parking spot should be displayed on the screen for at least 15 seconds while a reversing beeping sound is played during that time.
* *The first group in each class to complete this challenge will be awarded a compass sensor*

## Challenge 8: Back it up!

Place the robot on the highway so that it is positioned in the main lane of the highway with the rear wheels either in line with the front of the parking spot or slightly in front of it. You should code your robot to reverse parallel park into a 50cm spot. It should complete it in 3 manoeuvres. All parts of the robot must be fully within the parking spot (excluding the light sensor). The robot should be quite close to parallel with the edge of the road. It should play beeping sounds as it reverses.

* *Additional challenge: if your code can be successfully appended to your challenge 7 code and work correctly at least 3 times out of 4, your robot will be able to gain a skill medal.*

## Challenge 9: Fast and the furious

Place the robot on the highway so that it is positioned in the main lane of the highway. Your robot should move along the highway searching for a parking spot. Other ‘cars’ will be on the highway at the same time. These cars will also be searching for parking spots. They may stop and attempt to reverse into a spot at any time. You should always leave a suitable amount of room in front of you for other cars to be able to reverse. *(Hint: all cars should be able to park within a 50cm parking space).* Your robot will be presented with a variety of parking spots. You should only reverse into a spot that you can confidently manoeuvre into without crashing.

*The first group to successfully complete this challenge in each class will win a pack of playing cards for each group member.*

## Challenge 10: Chop shop

Use cardboard, corflute or other materials to build a cover for your car. The back of the car must be near vertical (so it can easily be detected by other cars). You should ensure that your cover is designed such that it doesn’t require excessive amounts of tape, still allows you to use the buttons and see the screen, connect the USB as well as the charger.

## Challenge 11: Parking…like a boss

*All groups who are up to this challenge will be given a compass sensor if they want to make use of one.*

Your challenge is to improve your parking algorithm to park in the smallest spot possible. Your score will be based on the ratio of the length of your robot to the length of the parking spot. You can make as many manoeuvres as needed though you have an overall time limit of 40 seconds from when you start reversing into the spot until the point at which you stop. Your robot must not touch the front or back of the spot. The robot must end up quite close to parallel to the parking lines when it is finished.

## Challenge 12: Driftin’

Your robot needs to be able to follow a bend in the road while performing all of the previously accomplished tasks

## Challenge 13: Uber Bus!

*All groups who are up to this challenge will be given an infrared sensor. You will also need to attach a push button to your robot.*

An infrared beacon will be placed in the parking spaces which will represent passengers who want to be picked up. Your car has capacity for 4 passengers. If you find a parking spot that you can safely pull into and that has passengers, you should park in it. Once parked your robot should wait 10 seconds for any passengers to leave, play a beep, then wait 10 seconds for passengers to board. Button presses within these time periods relate to a passenger leaving or boarding. At all times your robot should display the number of passengers on the bus. In the event that the bus becomes full (12 seater capacity), it should play a sound file to indicate that the bus is full.

*More challenges to come…*