Rules for AVC Challenge

Your vehicle must conform to the following specifications to be allowed to enter the challenge as a Competitor. If your vehicle doesn’t meet the specifications you will be classes as a Researcher. Competitor and Researchers will both be allowed to enter in the challenges we set for the vehicles, however only Competitors will be eligible to win.

The specifications to qualify as a Competitor are:

1. You cannot change the mass of the vehicle between events – it must be the same for all events
2. You must have an attachment point such that a looped piece of string can be easily attached and detached – i.e. a towbar, hook
3. Your robot must have an external on/off switch
4. Your robot must have an easy way to change the batteries

Other rules may be added at the judge’s discretion to ensure a fair and entertaining competition. Any rules added will be announced to the class as soon as they are decided on, via lectures, lab sessions, the ecs forums and moodle announcements.

Please treat the judges as customers, i.e. please solve the tasks by engineering rather than finding loopholes in the rules. Think whether your solution would make the customer happy!

The Events

The events that your vehicle has to complete in are:

Drag race - this is just a straight race on the carpet. The vehicle that has the quickest time to cover the distance (approx.. 2.5 - 3m) or the vehicle that gets the furthest down the track gets 10 points, 2nd place is 8 pts etc.

Slalom - this event has the robot manoeuvring through a series of gates. Points will be given for the quickest time to complete the course or the most gates passed through.

Mass lift - your robot has to lift as much mass as it can off the floor to a height of 50mm (5cm). We start on an amount you nominate and then go up in 50gm increments. Minimum amount is 50gm. Largest amount lifted gets the most points.

Maze - your robot has to navigate a 2m x 2m maze we have designed. There will be places in the maze that have two possible routes to go – each has a pro and a con. Points will be awarded for time to complete the maze or how far through the maze your vehicle gets.

Bridge of Doom - your robot has to cross a bridge across a valley using wireless commands from a controller you built. You will randomly draw your start position before the event and your robot will start from that point and attempt to cross the bridge. Points will be given based on how far across the bridge you get.

There is also two other areas that the vehicles are assessed on and that is recyclability and aesthetics. In recyclability we are looking specifically at how easy is it for us to get our parts back – the sensors, micro controllers, motors etc. And as a hint, we like nuts, bolts and screws on our parts. Also making it recyclable makes it easier to repair or change if you discover a problem with your current design.

Aesthetics is all about how good it looks. Does it look like a mess of wires and parts or is it tidy, or colourful etc. The hard part will be making it recyclable and aesthetically pleasing – because quite often those two things don’t go hand in hand. Apple products are a good example of this – they look pleasing and simple from an Aesthetic point of view – however they are not very recyclable/repairable.

The Hints

Start on the easiest event first – as most of the events build off from the easiest event.

Work on the code outside of the lab and use the lab time for testing and vehicle construction

Save working code into a different folder – take copies of the working code to change so that if you make changes that break something still have original working code.

The Parts

Each group will be provided with an Arduino Uno microcontroller, a Vicmoto motor driver board and a gearbox. These pieces will form the bases of your vehicle. Each team will be also given $100 virtual dollars to spend at Marvin’s Parts Bazaar to purchase sensors for their vehicles. You don’t need to spend all of your funds; however you must not go over the budget.

We have 5 different sensors available from the parts bazaar. They are:

* Short Range IR Sensor
* Medium Range IR sensor
* Ultrasonic Rangefinder
* QTR line follower sensor
* Lever action “Whisker” push buttons

You can swap out sensors you no longer need to get other sensors or get the funds added back to your budget, but only at the parts bazaar – you cannot swap parts with other groups.

If you want other sensors you will have to convince the judges that you require them and your group will have to purchase them. The University will not reimburse you for any parts brought for your vehicle. If you buy extra parts outside of the parts bazaar, the total cost of parts can not be greater than $100.

You can only use the Arduino we provide you as your microcontroller.

Batteries will be provided in each scheduled lab session which must be returned at the end of the lab. These are LiFe batteries, and need to be handled carefully so they are not damaged. If you wish to work on your vehicle outside of these times, you will need to sign out a battery from Arthur. This battery must be returned to Arthur.

Fresh batteries will be suppled for the Grand Final event and for the Heats.

Example code will be provided to everyone so you will have somewhere to start from.

Locomotion and Chassis

The wheels and chassis for your robots will have to be purchased or built by your teams. We will provide nuts, bolts and screws, hot glue guns and the glue for them, as well as ice block sticks, string/twine and a few other basic building materials. We will also have a drill press in the lab available for you all to use – I will take each lab session through a safety talk and safe use demonstration at the start of one of the labs sessions. We expect you to follow all safety instructions given to keep you and your fellow classmates safe.

Additional this year we have a laser cutting in the school which means we can cut chassis components out of acrylic. There are also some 3D printers available to print parts for use on the vehicle. Any parts to be laser cut or 3D printed have to be emailed to [**electronics@ecs.vuw.ac.nz**](mailto:electronics@ecs.vuw.ac.nz)**.** You must include your Group Name and Lab time in the email – preferable in the subject line.

Rules for 3D printed parts are:

A Single piece cannot be over 50 cubic mm in size (50 x 50 x 50, l x h x w)

Print time cannot exceed 3 hours per individual part – Sean will talk more about this.

Parts that are to be printed are required in .stl format.

Parts to be laser cut need to be adobe illustrator (.ai) files – eg cubechassis.ai. Check with your drawing program to see if you save these types of files. Also include the thickness of acrylic you want (3mm or 6mm) and the color of acrylic (black, red, clear)

Bookable Lab Slots

Each group will have, in addition to the scheduled lab times, 4 (this may change) bookable times in either CO242a or CO242b and 6 bookable lab times in CO145. There will be a sign up sheet for all of these times. You cannot trade slots between groups.

Possible times for bookable labs in CO145 (2h slots) could change to 1h slots

2h slots:

Mon 9-11am

1h slots:

Mon 9am, 10am, 11am

Wed 11am,

Fri 9am, 1pm, 4pm

Vehicle Storage

Each group will get a box to store their parts in and these will be stored in the shelves in CO145. You may only take your vehicle out of CO145 to take it up to CO242a or CO242b. When doing this you will be required to sign out your vehicle out of CO145 when you leave with the vehicle, and you must sign your vehicle back in when you bring it back to CO145.

This is so we can keep track of vehicles leaving the lab with one team member to be worked on and having other team members coming into CO145 and try to work on the vehicle to discover it’s not there.

Any vehicle caught outside CO145 and not being signed out, will cost that group a 5% penalty across their total score in the heats.