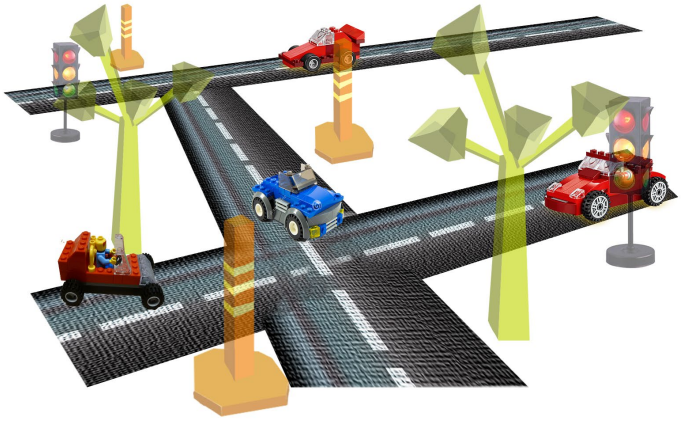
GATEWAYS JOURNEYS

G.A.T.E.WAYS invites high-ability Year 3 & 4 students with a love of STEM to …

Welcome to M City: The Testing Ground of the Future



This Journey will focus on developing children's science and technology skills by teaching them to build and program working Lego models of driverless vehicles. They will use Lego models and the Scratch programming language to test various scenarios.

Welcome to M-City and to the engineering and coding team in charge of vehicle design and programming. Driverless vehicles are the way of the future, with the potential to reduce the number of road accident deaths to zero. But our roads pose many challenges, from the interference of trees and building materials with GPS navigation, to the unpredictable movements of other cars and pedestrians. Can you design and program an automated vehicle with the ability to drive safely in the real world?

This journey includes four phases of learning:

- Connecting with the mission and challenge through your mission guidebook.
- Constructing a testing environment with appropriate real-world materials.
- Coding a programming sequence for your model to follow.
- Continuing to use your skills to design and program the ultimate driverless car.

Requirements:

- Bring your pencil case, an A4 exercise book or notepad, and a snack (no nuts please)
- If you are participating in Term 1 or 4, you must bring a hat for the break.

Session 1: Crash Test Dummies **(Lego NXT)**

Did you know that car accidents have a lot in common with a game of billiards? In this session, all girls and boys will be welcomed to the M-City Crash Test investigation Unit by fellow technology specialists Alexandra and Lee, who will show you around the different departments of the facility. Today we will be investigating the principle of momentum. Momentum causes passengers to keep moving after a car stops suddenly or crashes, unless they are wearing a seatbelt. This is also why baby and child seats are so important to safety. We will then see momentum in action as we experiment with billiard balls, then put our knowledge to the test with a Lego NXT crash simulator. We'll program a robotic braking switch to hold a test car in suspension at the top of a bridge, then release it to roll down a hill and gather momentum until it hits a wall or another car. What happens to the crash test family with and without their seat belts and car seats? Make sure you use your mission guidebook to record your observations.

Session 2: Driving the Maze **(Scratch Coding)**

Your next stop is the M-City Virtual Testing Lab. This state of the art computer simulator allows designers and programmers to try ideas out on screen to get them ready for the physical test track. Alexandra has been having some eye trouble, and has recently been prescribed glasses to allow her to see clearly when driving. In this session we'll learn about vision problems that can affect drivers and lead to accidents on the road. We will program a virtual maze using Scratch, then try to navigate it with manual controls using different vision-impairing goggles. If we can do it, Lee will set an extra challenge. We must remove the human operated controls and write Scratch code to allow the virtual car to navigate the maze by itself. Eek!!

Session 3: Keeping Your Distance **(Ultrasonic and Sound Sensors)**

Personal space is important on the road. In this session, Alex will introduce us to the M-City physical test track - where driverless cars are tested in a realistic road system with schools, bakeries, office towers, houses, other vehicles and pedestrians. There's even a fire station! We'll learn about the physics behind braking systems, and the optimum distance between cars at a range of speeds. Using Lego NXT, we'll then fit our cars with ultrasonic sensors, and program them to stay the correct safe distance behind another vehicle. Lee needs to pick up his children from the M-City school, can you brave the traffic without crashing into the other parents' cars? As an extra challenge, you will install a sound sensor, and program it to get your car to come when you call.

Session 4: M-City Madness **(Putting It All Together)**

The roads are busy places, and driverless cars must be ready for anything. Alexandra and Lee are so impressed with our progress that they have put you in charge of a shift on the physical test track. Use your mission guidebook to plan for all the challenges your car will face in the real world - from power failures to jay-walking pedestrians. Your first challenge will be to program randomisation into the autonomous vehicles using Lego NXT, to simulate the unexpected nature of real-world commuting. You will install light sensors to allow vehicles to follow lines to keep to their lanes, and sense different coloured dots (future traffic lights). To allow your cars to navigate the complex road network of the M-City test track, you will also need to install and program high-tech trigger and loop sensors for forks in the road. Fire alarms start going off all over M-City and Mary the fire engine driver has broken her leg! Can you use your driverless vehicles to rescue the people of M-City and drive them to the hospital safely?

About the presenter:

Mark Maxwell is an artist and workshop presenter. His practice encompasses marques, woodwork, building, animation, set design and lighting. When creating miniature models he explores engineering principles and tries to design projects that promote open ended creativity. Mark has completed an Art and Design degree and has worked as technical engineer in many theatres. He presents workshops for Regional Arts Victoria, which brings professional art practitioners to schools, community groups, art galleries, libraries and art festivals.