Autonomous Robot Car – WACE Curriculum Mapping

In the Autonomous Robot Car project, students build and code an Arduino-powered robot capable of driving around and avoiding obstacles autonomously, using DC motors, an ultrasonic sensor and a motor driver. The following tables map this project against the Western Australian Curriculum (WACE), across Design & Technologies, Digital Technologies and Science, for Years 3–4, 5–6, 7–8 and 9–10.

Design & Technologies

The Design & Technologies content below traces how students investigate forces, motors and energy transfer, select and justify chassis and drivetrain components, sketch and communicate design ideas, safely produce their robot, and evaluate its navigation performance against design criteria.

Years 3–4

Table 1: Design & Technologies (Years 3–4)

Relevant Code	Application to Project	General Capabilities
WA3/4TDECEP1 – *Objects can be moved when a force is applied.*	Students investigate how DC motors apply rotational force to drive the wheels, while gears transfer motion to move the robot. They observe how electrical energy powers the motors and enable movement.	• Literacy • Critical & Creative Thinking
WA3/4TDETS1 – *Explore how familiar technologies meet personal and community needs.*	Students explore how robots and autonomous technologies assist people in everyday life, including transport, manufacturing and household automation.	• Personal & Social Capability • Critical & Creative Thinking
WA3/4TDEDTID1 – *Explore the purpose for designing a solution.*	Students identify the purpose of designing a robot capable of navigating independently and avoiding obstacles without human intervention.	• Critical & Creative Thinking
WA4TDEDTID2 – *Investigate and select resources based on their properties.*	Students select suitable motors, wheels, ultrasonic sensors, batteries and structural components to construct a reliable autonomous vehicle.	• Critical & Creative Thinking
WA3/4TDEDTPI1 – *Design solutions through discussion, modelling and drawings.*	Students create labelled sketches showing the robot chassis, sensor placement and wheel arrangement before construction.	• Literacy • Critical & Creative Thinking
WA3/4TDEDTPI1 – *Use available technologies and materials to safely create a solution.*	Students safely assemble the chassis, wire electronic components, install sensors and test the robot while following workshop safety procedures.	• Personal & Social Capability • Critical & Creative Thinking
WA3/4TDEDTPM1 – *Share ideas to develop a solution.*	Students explain how their robot detects obstacles, discuss programming decisions and demonstrate autonomous navigation.	• Literacy • Personal & Social Capability

Relevant Code	Application to Project	General Capabilities
WA3/4TDEDTE1 – *Use personal preferences to evaluate the solution.*	Students evaluate how effectively the robot avoids obstacles and identify improvements to its movement and overall performance.	• Critical & Creative Thinking

Years 5–6

Table 2: Design & Technologies (Years 5–6)

Relevant Code	Application to Project	General Capabilities
WA5/6TDECEP1 – *Investigate how forces and energy transfer affect designed solutions.*	Students investigate how electrical energy is converted into mechanical motion, and how motors, gearboxes and wheel systems work together to propel the robot.	• Literacy • Critical & Creative Thinking
WA5/6TDETS1 – *Examine how technologies meet present and future needs.*	Students investigate how autonomous robots are used in transport, logistics, agriculture and industry to improve safety and efficiency.	• Ethical Understanding • Critical & Creative Thinking
WA5/6TDEDTID1 – *Investigate needs or opportunities for designed solutions.*	Students identify the engineering requirements needed to design a robot capable of detecting and avoiding obstacles autonomously.	• Critical & Creative Thinking
WA5/6TDEDTID2 – *Investigate and select suitable materials, components and technologies.*	Students compare motors, ultrasonic sensors, motor drivers, rechargeable batteries and chassis components before selecting the most appropriate solution.	• Critical & Creative Thinking
WA5/6TDEDTPI1 – *Develop and communicate design ideas.*	Students create annotated engineering drawings, circuit layouts and wiring diagrams before constructing the robot.	• Literacy • Critical & Creative Thinking
WA5/6TDEDTPI1 – *Safely produce designed solutions.*	Students assemble, wire, program and test the robot while following safe engineering practices and electrical safety procedures.	• Personal & Social Capability
WA5/6TDEDTPM1 – *Plan, manage and communicate production processes.*	Students organise assembly, programming and testing while documenting improvements made throughout development.	• Literacy • Personal & Social Capability
WA5/6TDEDTE1 – *Evaluate designed solutions against identified criteria.*	Students evaluate navigation accuracy, turning performance, obstacle detection and reliability before refining their robot.	• Critical & Creative Thinking

Years 7–8

Table 3: Design & Technologies (Years 7–8)

Relevant Code	Application to Project	General Capabilities
WA7/8TDECEP1 – *Analyse how forces, motion and energy influence engineered systems.*	Students investigate how motor torque, wheel diameter, gear reduction, friction and battery performance influence the robot's speed, steering and climbing ability.	• Literacy • Critical & Creative Thinking
WA7/8TDETS1 – *Investigate how technologies contribute to preferred futures.*	Students explore how autonomous vehicles and robotic systems are transforming transport, healthcare, manufacturing and environmental monitoring.	• Ethical Understanding • Critical & Creative Thinking
WA7/8TDEDTID1 – *Investigate and define design problems.*	Students analyse engineering constraints including chassis stability, sensor placement, power consumption and navigation accuracy before designing a solution.	• Critical & Creative Thinking
WA7/8TDEDTID2 – *Investigate and select suitable resources.*	Students evaluate motors, motor drivers, ultrasonic sensors, batteries and structural components based on reliability, efficiency and performance.	• Critical & Creative Thinking
WA7/8TDEDTID3 – *Consider available technologies, resources and components to develop solutions.*	Students justify engineering decisions by comparing hardware options, cost, functionality and ease of maintenance.	• Critical & Creative Thinking
WA7/8TDEDTPI1 – *Develop and communicate design ideas.*	Students produce engineering drawings, wiring schematics and chassis layouts before manufacturing the robot.	• Literacy • Critical & Creative Thinking
WA7/8TDEDTPI1 – *Safely produce designed solutions.*	Students manufacture, assemble, wire and program an autonomous robot while applying safe engineering and workshop practices.	• Personal & Social Capability
WA7/8TDEDTPM1 – *Plan, manage and document production processes.*	Students manage prototype development, record testing data and refine the robot using an iterative engineering process.	• Literacy • Personal & Social Capability
WA7/8TDEDTE1 – *Evaluate designed solutions using design criteria.*	Students evaluate navigation reliability, obstacle avoidance, structural strength and energy efficiency against engineering success criteria.	• Critical & Creative Thinking

Years 9–10

Table 4: Design & Technologies (Years 9–10)

Relevant Code	Application to Project	General Capabilities
WA9/10TDECEP1 – *Analyse engineering principles including force, motion, energy and control systems.*	Students analyse how motor torque, gear reduction, differential drive systems, power management and sensor integration influence the robot's autonomous performance and efficiency.	• Literacy • Critical & Creative Thinking

Relevant Code	Application to Project	General Capabilities
WA9/10TDETS1 – *Evaluate the role of technologies in preferred futures.*	Students evaluate how autonomous robotic systems contribute to safer, more efficient and sustainable solutions in transport, manufacturing, agriculture and logistics.	• Ethical Understanding • Critical & Creative Thinking
WA9/10TDEDTID1 – *Critically investigate and define complex design problems.*	Students develop an engineering design brief considering autonomous navigation, obstacle avoidance, energy efficiency, maintainability and system reliability.	• Critical & Creative Thinking
WA9/10TDEDTID2 – *Investigate and select suitable resources.*	Students evaluate alternative sensors, motor drivers, batteries, chassis materials and embedded hardware to optimise performance, reliability and cost.	• Critical & Creative Thinking
WA9/10TDEDTID3 – *Evaluate technologies, components and production processes.*	Students justify engineering decisions by comparing hardware configurations, analysing prototype testing data and selecting the most effective production methods.	• Critical & Creative Thinking
WA9/10TDEDTPI1 – *Develop and communicate engineering solutions.*	Students produce detailed engineering drawings, circuit schematics, wiring diagrams and technical documentation before constructing the robot.	• Literacy • Critical & Creative Thinking
WA9/10TDEDTPI1 – *Safely produce and refine designed solutions.*	Students manufacture, assemble, wire, program and iteratively refine a complete autonomous robotic system while applying safe engineering and workshop practices.	• Personal & Social Capability
WA9/10TDEDTPM1 – *Manage production processes and evaluate outcomes.*	Students manage project timelines, document software and hardware iterations, evaluate testing results and refine the robot using an iterative engineering process.	• Literacy • Personal & Social Capability
WA9/10TDEDTE1 – *Critically evaluate designed solutions against success criteria.*	Students critically evaluate navigation accuracy, obstacle avoidance, reliability, maintainability, energy efficiency and overall engineering performance, recommending evidence-based improvements for future development.	• Critical & Creative Thinking

Digital Technologies

The Digital Technologies content below traces how students investigate the Arduino, sensor and motor driver as an integrated digital system, design and implement obstacle-avoidance algorithms, represent sensor data digitally, and produce and evaluate their coded solution.

Years 3–4

Table 5: Digital Technologies (Years 3–4)

Relevant Code	Application to Project	General Capabilities
WA3/4DIGDS1 – *Investigate how digital*	Students identify how the Arduino, ultrasonic sensor, motor driver, DC motors and battery	• Digital Literacy

Relevant Code	Application to Project	General Capabilities
systems use hardware components to perform tasks.	system work together to allow the robot to move and detect obstacles.	
WA3/4DIGDI1 – *Design algorithms using flowcharts including branching and repetition.*	Students create flowcharts describing how the robot detects an obstacle, stops, turns and continues driving.	• Digital Literacy
WA3/4DIGDI2 – *Implement algorithms using branching and repetition.*	Students program simple obstacle avoidance behaviours using loops, conditional statements and timing delays.	• Digital Literacy
WA3/4DIGDTID1 – *Investigate and define a design opportunity.*	Students identify the features required for a robot capable of moving safely without colliding with objects.	• Critical & Creative Thinking
WA4DIGDTID2 – *Select suitable resources for a solution.*	Students choose appropriate motors, sensors, batteries and structural components for an autonomous vehicle.	• Critical & Creative Thinking
WA3/4DIGDTDE1 – *Design solutions using labelled diagrams.*	Students sketch the chassis layout, sensor placement and wiring before construction begins.	• Critical & Creative Thinking
WA3/4DIGDTPI1 – *Safely produce a designed solution.*	Students assemble the robot chassis, wire the electronics and test autonomous movement following safe workshop procedures.	• Critical & Creative Thinking • Personal & Social Capability • Digital Literacy
WA3/4DIGDTPM1 – *Follow plans and communicate ideas.*	Students follow engineering instructions, collaborate during construction and evaluate the robot's performance.	• Literacy • Personal & Social Capability

Years 5–6

Table 6: Digital Technologies (Years 5–6)

Relevant Code	Application to Project	General Capabilities
WA5/6DIGDS1 – *Investigate digital system components and their interactions.*	Students investigate how the Arduino processes sensor input and controls motor outputs to enable autonomous navigation.	• Digital Literacy
WA5/6DIGDI1 – *Design algorithms incorporating variables, user input and control structures.*	Students design obstacle avoidance algorithms using variables, functions, loops and conditional statements.	• Numeracy • Digital Literacy
WA5/6DIGDI2 – *Implement algorithms*	Students develop Arduino programs that continuously monitor distance measurements and make driving decisions.	• Numeracy • Digital Literacy

Relevant Code	Application to Project	General Capabilities
using variables and iteration.		
WA5/6DIGDTID1 – *Investigate project requirements and constraints.*	Students identify design requirements including stability, battery life, turning radius and obstacle detection accuracy.	• Critical & Creative Thinking
WA5/6DIGDTID2 – *Select resources based on design requirements.*	Students justify their selection of motors, ultrasonic sensors, motor drivers and rechargeable power systems.	• Critical & Creative Thinking
WA5/6DIGDTDE1 – *Develop and refine design solutions.*	Students improve chassis design, sensor positioning and navigation algorithms through iterative testing.	• Critical & Creative Thinking
WA5/6DIGDTPI1 – *Produce and evaluate a digital solution.*	Students integrate electronics, programming and mechanical systems into a fully autonomous robot.	• Critical & Creative Thinking • Personal & Social Capability • Digital Literacy
WA6DIGDR1 – *Represent data digitally.*	Students investigate how ultrasonic distance measurements, PWM values and digital signals are represented within the Arduino.	• Numeracy • Digital Literacy
WA5/6DIGDTPM1 – *Manage project resources and timelines.*	Students organise assembly, programming and testing while documenting improvements made throughout development.	• Literacy • Personal & Social Capability

Years 7–8

Table 7: Digital Technologies (Years 7–8)

Relevant Code	Application to Project	General Capabilities
WA7/8DIGDS1 – *Investigate communication within digital systems.*	Students investigate how embedded systems communicate with ultrasonic sensors, motor drivers and actuators to make autonomous decisions.	• Digital Literacy
WA7/8DIGDS2 – *Evaluate hardware for intended purposes.*	Students compare different sensors, motors and power systems to improve robot performance and reliability.	• Digital Literacy
WA7/8DIGDI1 – *Analyse user experience.*	Students evaluate how navigation accuracy, turning behaviour and response times improve the robot's effectiveness in different environments.	• Critical & Creative Thinking • Digital Literacy
WA7/8DIGDI2 – *Design algorithms using pseudocode and flowcharts.*	Students develop structured navigation algorithms incorporating sensor feedback, branching and repeated decision-making.	• Numeracy • Digital Literacy

Relevant Code	Application to Project	General Capabilities
WA7DIGDI3 / WA8DIGDI3 – *Test and refine algorithms.*	Students systematically debug autonomous navigation code and improve obstacle detection reliability.	• Digital Literacy (WA8 also Numeracy)
WA8DIGDI4 – *Implement solutions using a general-purpose programming language.*	Students develop modular Arduino C++ libraries for motor control, sensor integration and autonomous navigation.	• Digital Literacy
WA7/8DIGDTID1–3 – *Investigate design opportunities and evaluate resources.*	Students evaluate engineering constraints including speed, turning radius, power consumption and sensor placement before selecting an optimal solution.	• Literacy (DTID1) • Critical & Creative Thinking
WA7/8DIGDTDE1 – *Design and refine digital solutions.*	Students iteratively improve chassis design, navigation algorithms and sensor positioning based on testing data.	• Critical & Creative Thinking
WA7/8DIGDTPI1 – *Produce and evaluate digital solutions.*	Students integrate mechanical, electronic and software systems into a reliable autonomous vehicle.	• Critical & Creative Thinking • Personal & Social Capability • Digital Literacy
WA7/8DIGDR1 – *Represent and manipulate digital data.*	Students investigate how sensor readings, PWM values and Boolean variables are processed to control robot behaviour.	• Numeracy • Digital Literacy
WA7/8DIGDTPM1 – *Apply project management processes.*	Students manage engineering tasks, document testing outcomes and refine prototypes through iterative development.	• Personal & Social Capability

Years 9–10

Table 8: Digital Technologies (Years 9–10)

Relevant Code	Application to Project	General Capabilities
WA9/10DIGDS1 – *Investigate integrated hardware and software systems.*	Students investigate how embedded controllers, sensors, motor drivers and power management systems interact to produce autonomous behaviour.	• Digital Literacy
WA9/10DIGDI1 – *Define and decompose engineering problems.*	Students analyse the autonomous navigation challenge by identifying functional requirements, engineering constraints and performance criteria.	• Numeracy • Digital Literacy
WA9/10DIGDI2 – *Design user experiences.*	Students evaluate autonomous driving performance and optimise navigation behaviours for different operating environments.	• Critical & Creative Thinking • Digital Literacy
WA9/10DIGDI3 – *Design modular algorithms.*	Students create reusable Arduino functions for sensor processing, motor control, navigation and decision-making.	• Digital Literacy

Relevant Code	Application to Project	General Capabilities
WA9/10DIGDI4 – *Validate algorithms through testing.*	Students systematically test navigation algorithms, evaluate performance data and optimise obstacle avoidance routines.	• Numeracy • Digital Literacy
WA9/10DIGDI5 – *Implement modular programs.*	Students develop efficient Arduino C++ software using functions, libraries and modular programming techniques to control autonomous operation.	• Digital Literacy
WA9/10DIGDTID1–3 – *Investigate stakeholder needs and engineering constraints.*	Students develop a formal engineering design brief, evaluate alternative drive systems and justify hardware and software decisions using evidence from testing.	• Literacy (DTID1) • Critical & Creative Thinking
WA9/10DIGDTDE1 – *Design and refine digital solutions.*	Students iteratively improve the mechanical chassis, sensor configuration and software architecture to maximise navigation performance and reliability.	• Critical & Creative Thinking
WA9/10DIGDTPI1 – *Produce and evaluate digital solutions.*	Students construct, program and evaluate a complete autonomous robotic system that integrates embedded software, electronic circuits and mechanical engineering principles.	• Critical & Creative Thinking • Personal & Social Capability • Digital Literacy
WA9DIGDR1 / WA9DIGDR2 – *Represent and manipulate digital data.*	Students investigate how ultrasonic measurements, PWM signals, Boolean logic and variables are represented, stored and processed within an embedded system to enable autonomous decision-making.	• Numeracy • Digital Literacy
WA9/10DIGDTPM1 – *Manage digital projects.*	Students apply engineering project management by documenting design iterations, managing testing schedules, evaluating performance and refining solutions using an iterative engineering process.	• Literacy • Personal & Social Capability • Critical & Creative Thinking (Years 9–10 also include Numeracy and Ethical Understanding)

Science

The Science content below traces how students investigate energy transfer through the robot's motors and circuit, the mechanical advantage of its wheel-and-axle drivetrain, and pose questions, plan investigations, and communicate and apply their scientific understanding of forces, energy and electricity.

Years 3–4

Table 9: Science (Years 3–4)

Relevant Code	Application to Project	General Capabilities
WA3/4SSUP1 – *Energy can change forms and transfer to other entities.*	Students investigate how electrical energy from the battery is transferred through the circuit and converted into mechanical energy by the DC motors to move the robot.	• Numeracy • Critical & Creative Thinking
WA3/4SSIQ1 – *Pose questions and make predictions.*	Students predict how changing variables such as wheel size, motor speed or sensor position will affect the robot's movement and obstacle avoidance.	• Critical & Creative Thinking
WA3/4SSIPL1 – *Plan and conduct investigations.*	Students conduct fair tests by changing one variable at a time while measuring how the robot performs in different environments.	• Numeracy • Critical & Creative Thinking
WA3/4SSIPR1 – *Organise and represent data.*	Students record observations of travel distance, obstacle detection and navigation success using tables or simple graphs to identify patterns.	• Numeracy
WA3/4SSIE1 – *Evaluate investigations.*	Students compare the robot's performance with their predictions, discuss whether the investigation was fair and identify improvements.	• Critical & Creative Thinking
WA3/4SSICM1 – *Communicate scientific ideas.*	Students explain how electrical energy, motors and sensors work together to enable autonomous movement using appropriate scientific vocabulary.	• Literacy
WA3/4SSICL1 – *Apply science knowledge.*	Students apply their understanding of energy transfer and forces to explain how the robot detects obstacles and moves independently.	• Critical & Creative Thinking

Years 5–6

Table 10: Science (Years 5–6)

Relevant Code	Application to Project	General Capabilities
WA5/6SSUP1 – *Energy can change forms and transfer to other entities.*	Students investigate how electrical energy is converted into mechanical energy to drive the robot while powering sensors and control electronics.	• Numeracy • Critical & Creative Thinking
WA5/6SSIQ1 – *Pose questions and make predictions.*	Students develop investigable questions about how motor speed, wheel diameter or ultrasonic sensor position affects navigation accuracy.	• Critical & Creative Thinking
WA5/6SSIPL1 – *Plan and conduct investigations.*	Students design fair investigations by identifying independent, dependent and controlled variables when testing robot performance.	• Numeracy • Critical & Creative Thinking
WA5/6SSIPR1 – *Organise and represent data.*	Students collect and analyse data such as obstacle detection distance, travel time and turning accuracy using tables and graphs.	• Numeracy

Relevant Code	Application to Project	General Capabilities
WA5/6SSIE1 – *Evaluate investigations.*	Students compare findings with predictions, evaluate the reliability of their testing and recommend improvements to the robot.	• Critical & Creative Thinking
WA5/6SSICM1 – *Communicate scientific ideas.*	Students communicate explanations of energy transfer, motion, forces and sensing technologies using scientific terminology.	• Literacy
WA5/6SSICL1 – *Apply science knowledge.*	Students explain how motors, sensors and energy transfer work together to produce autonomous movement and obstacle avoidance.	• Critical & Creative Thinking

Years 7–8

Table 11: Science (Years 7–8)

Relevant Code	Application to Project	General Capabilities
WA7/8SSUP1 – *Energy can change forms and transfer to other entities.*	Students investigate how electrical energy is transferred through the system and transformed into mechanical motion by the DC motors while powering sensors and electronic components.	• Numeracy • Critical & Creative Thinking
WA7SSUP2 – *Simple machines provide mechanical advantage.*	Students investigate how the robot's wheels and axles reduce friction and convert rotational motion into linear movement, and how wheel diameter influences speed and torque.	• Numeracy • Critical & Creative Thinking
WA7/8SSIQ1 – *Pose questions and make predictions.*	Students formulate hypotheses about how changing wheel size, gear ratio, motor speed or sensor placement affects navigation performance.	• Critical & Creative Thinking
WA7/8SSIPL1 – *Plan and conduct investigations.*	Students conduct controlled investigations by systematically changing one variable while measuring robot speed, turning ability and obstacle detection.	• Numeracy
WA7/8SSIPR1 – *Process and analyse data.*	Students analyse experimental data to identify relationships between mechanical design, programming variables and autonomous performance.	• Numeracy
WA7/8SSIE1 – *Evaluate investigations.*	Students evaluate the validity of their investigation, compare findings with predictions and recommend evidence-based improvements.	• Critical & Creative Thinking
WA7/8SSICM1 – *Communicate scientific ideas.*	Students communicate explanations of energy transfer, force, motion and autonomous sensing using scientific language and diagrams.	• Literacy
WA7/8SSICL1 – *Apply science knowledge.*	Students apply their understanding of forces, energy and simple machines to improve robot efficiency and navigation performance.	• Critical & Creative Thinking

Years 9–10

Table 12: Science (Years 9–10)

Relevant Code	Application to Project	General Capabilities
WA9/10SSUP1 – *Energy can change forms and transfer to other entities.*	Students analyse how electrical energy from the battery is transformed into mechanical work by the motors while simultaneously powering sensors and embedded electronics, and evaluate factors affecting energy efficiency.	• Numeracy • Critical & Creative Thinking
WA9SSUP2 – *Simple machines provide mechanical advantage.*	Students analyse how the wheel-and-axle system provides mechanical advantage and investigate how wheel diameter, traction and torque influence robot speed, acceleration and manoeuvrability.	• Numeracy • Critical & Creative Thinking
WA8/9SSUP3 – *The flow of electricity through a circuit is affected by the type of circuit; loads transform electrical energy; safety devices protect electrical systems.*	Students investigate how current flows through the robot's electrical circuit, how motors and sensors act as electrical loads, and why correct wiring, circuit protection and battery safety are essential for reliable operation.	• Numeracy • Critical & Creative Thinking
WA9/10SSIQ1 – *Pose questions and make predictions.*	Students formulate hypotheses about how mechanical, electrical and programming variables influence navigation accuracy, efficiency and reliability.	• Critical & Creative Thinking
WA9/10SSIPL1 – *Plan and conduct investigations.*	Students design controlled investigations by identifying variables, collecting accurate measurements and evaluating robot performance under different operating conditions.	• Numeracy
WA9/10SSIPR1 – *Process, model and analyse data.*	Students use tables, graphs and data analysis to identify trends between sensor readings, motor performance and autonomous navigation outcomes.	• Numeracy
WA9/10SSIE1 – *Evaluate investigations.*	Students critically evaluate evidence, compare findings with predictions and recommend evidence-based improvements to both the robot and the investigation.	• Critical & Creative Thinking
WA9/10SSICM1 – *Communicate scientific ideas.*	Students communicate explanations of electrical circuits, energy transformations, force, motion and autonomous sensing using precise scientific vocabulary and appropriate representations.	• Literacy
WA9/10SSICL1 – *Apply science knowledge.*	Students apply their understanding of physics principles to optimise robot performance, explain autonomous behaviour and solve engineering challenges using scientific evidence.	• Critical & Creative Thinking