

**Internal Assessment Resource**

**Digital Technologies & Hangarau Matihiko Level 2**

This resource supports assessment against Achievement Standard 918941

**Standard title:** Use advanced techniques to develop an electronics outcome

**Credits:** 6

**Resource title:** Monitoring Systems

**Resource reference:** Digital Technologies & Hangarau Matihiko 2.5A

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| This resource:   * Clarifies the requirements of the achievement standard * Supports good assessment practice * Should be subjected to the school’s usual assessment quality assurance process * Should be modified to make the context relevant to students in their school/kura environment and ensure that submitted evidence is authentic |

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| Date version published by Ministry of Education | December 2018 Version 1  To support internal assessment from 2019 |
| Authenticity of evidence | Teachers/kaiako must manage authenticity for any assessment from a public source, because students may have access to the assessment schedule or student exemplar material.  Using this assessment resource without modification may mean that students’ work is not authentic. The teacher may need to change figures, measurements or data sources or set a different context or topic to be investigated or a different text to read or perform. |

Achievement standard 91894 is derived from both *The New Zealand Curriculum* and *Te* *Marautanga o Aotearoa.*

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**Teacher/Kaiako guidelines**

The following guidelines are supplied to enable teachers/kaiako to carry out valid and consistent assessment using this internal assessment resource.

Teachers/kaiako need to be very familiar with the outcome being assessed by the achievement standard. The achievement criteria and the explanatory notes contain information, definitions, and requirements that are crucial when interpreting the standard and assessing students/ākonga against it.

**Context/Te Horopaki**

What can we enhance the performance of by monitoring over time? The assessment activity provides scope for students to develop a range of refined electronic systems that are capable of monitoring over time. Possible student projects may include:

* Monitoring of a mailbox over time for an elderly person and alert user when mail is present.
* Monitoring soil temperature and moisture over time and open/close a water valve.
* Monitoring wood moisture in home floor boards or firewood over time and alerting user when needed.
* Monitoring the temperature of a laptop and controlling and/or timing of a cooling fan.

Teachers should ensure the rigour of the outcome is appropriate for Level 7 of the NZ Curriculum. The specifications need to be agreed to prior to the implementation of interfacing procedures. They may be teacher-given or developed in negotiation with the student.

**Conditions/Ngā Tikanga**

Conditions of Assessment related to this achievement standard can be found at <http://ncea.tki.org.nz/Resources-for-Internally-Assessed-Achievement-Standards>

**Resource requirements/Ngā Rauemi**

The list of resources for this standard will depend on the teaching and learning programme. Students will need access to appropriate electronics components and equipment that could include:

* Microprocessor such as Atmel / Picaxe / Arduino or *System on a Chip* products such as Raspberry-Pi along with programming cables
* Power Supplies
* Electronic components and a range of input components, sensors and output devices
* Multimeters, Breadboard components, Vero board or Kiwi Patch boards or Printed Circuit Board equipment.

Students will need access to a computer with appropriate IDE’s for writing and downloading code into a Microprocessor. For teachers new to electronics there are a number of suppliers within New Zealand that are able to supply components.

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**Student/Akonga instructions**

**Introduction/Kupu Arataki**

What can we enhance the performance of by monitoring over time?

This assessment activity requires you to develop an electronics outcome that is able to monitor over time. Possible ideas include:

* Monitoring of a mailbox over time for an elderly person and alert user when mail is present.
* Monitoring soil temperature and moisture over time and open/close a water valve.
* Monitoring wood moisture in home floor boards or firewood over time and alerting user when needed.
* Monitoring the temperature of a laptop and controlling and/or timing of a cooling fan.

You are going to be assessed on the advanced techniques shown in the development of a refined electronics outcome.

You may work with others to help generate ideas and develop those ideas. However, you will be expected to show your own thinking and evidence of how you discussed and combined ideas together to write and submit your own work.

Teacher note: Insert due dates and timeframes

**Task/Hei Mahi**

1. Use appropriate resources and techniques to develop a functional outcome that performs to specifications and addresses relevant implications. Record your development process undertaken (e.g. photos, notes etc) of the stages you move through and clearly annotate/label each interface and the iterative improvements or refinements made throughout the design, development and testing process to produce a high-quality electronics outcome.
2. Test all input interfaces, output interfaces and debug any issues to ensure that the electronics outcome:
   * has well-structured code
   * functions as intended
   * is reliable
   * is skilfully constructed

You should list the tests you performed, and any modifications to components or software code because of tests.

1. Explain the interfaces, and functions of the components and systems AND explain the behaviour and function of the electronics outcome. This can be done either through photos and annotations, or through written description of at least three of the following (choose three which directly apply to your own electronics outcome):
   * Analogue Inputs: Voltage, Current and Resistance characteristics and an explanation of Analogue to Digital Conversion
   * Switch De-bouncing: An explanation of, and techniques to resolve it within either hardware or software
   * Transistor behaviour and current gain and its impact on transistor selection
   * Servo control and an explanation of Pulse Wave Modulation
   * Motor control, the consequences of back EMF and an explanation of how this can be mitigated using components
   * H-Bridge purpose and an explanation of how to functions
   * Shift Registers and an explanation of how a shift register enables additional inputs/outputs to be added to a Microprocessor.
2. Explain and address relevant implications of the electronics outcome, such as
   * why software code needs to meet codes of practice
   * why the system needs to meet end-user specifications
   * why the system needs to comply with all relevant intellectual property.

Link this explanation to your electronics outcome and show how you have addressed these in the outcome.

1. Evaluate and justify the choice of the components and systems used.

**Assessment schedule/Mahere Aromatawai: Digital Technologies & Hangarau Matihiko 91894 – Monitoring Systems**

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| **Evidence/Judgements for Achievement/Paetae** | **Evidence/Judgements for Achievement with Merit/Kaiaka** | **Evidence/Judgements for Achievement with Excellence/Kairangi** |
| Use advanced techniques to develop an electronics outcome.  The student has:   * used appropriate resources and techniques to develop a functional outcome   Student has developed a functional electronics outcome that meets specifications. Each interface works, and the student is able to demonstrate a working monitoring system.   * tested and debugged to ensure that the outcome performs to specifications   Student has shown evidence of:   * testing the input interface on expected analogue/digital inputs * testing the output interfaces to show system status and/or actuator control * modifying code beyond any template or teacher supplied code samples * explained the interfaces and functions of components and systems   Student has explained the function of at least 3 interfaces / components within their outcome**.**  **For example (partial evidence):**  Student has explained the reason they selected input or output interfaces, or reasons for using specific embedded software code  For example:   * Why the student chose to use a 4-digit pass code instead of a RFiD scanner * Why the student chose to use variables that define the state of the latch rather than just switch positions based on conditional statements * Why the student chose to use a servo instead of a DC latching solenoid for the locking mechanism. * explained relevant implications   Student has explained implications that may include   * why software code needs to meet codes of practice * why the system needs to meet end-user specifications * why the system needs to comply with all relevant intellectual property.   *The examples above are indicative samples only* | Use advanced techniques to develop an informed electronics outcome.  The student has:   * explained the behaviour and function of the electronics outcome   The student has explained what the Monitoring system will actually do and how the components worked together to make this happen.  **For example**  Student describes the concept of switch debouncing and its effect on the monitoring system. Then explains how software solution can be used to ensure the system does not register incorrect inputs from the switch.   * tested and modified to ensure reliability   Student is able to test and show reliability in their electronics outcome. This may include   * Placing each planned component for a modelled system on a well organised breadboard layout, testing for loose components. Evidence that the system can function in a consistent manner in its intended location, before soldering components on a Vero board, Kiwi Patch board or Printed Circuit board. Providing evidence of improved reliability and robustness as long as the system is proven to work in a consistent manner in its intended location * evaluated the choice of components and systems used   Student is able to collate together costs associated with each component and the system as a whole.   * addressed relevant implications   Student has addressed implications that include   * well-structured code. The software code is well structured, including variable and constant declaration. Code comments etc. * functions as intended. The student resolves any issues that affect the functioning of the system. * is reliable. The student addresses concerns over reliability that may include soldering components onto a board, enclosures with mounted components, secure wiring. * meets all copyright or intellectual property concerns.   *The examples above are indicative samples only* | Use advanced techniques to develop a refined electronics outcome.  The student has:   * undertaken iterative improvement throughout the design, development and testing process to produce a high-quality outcome   Student shows evidence of ongoing design, development and testing within the process of constructing the electronics outcome. The student should be able to show multiple instances of development and testing that lead to a functional outcome.  Measures should include the use of a deliberate considered cyclic improvement of the outcome. Evidence is required of various versions, which may include:   * improvements to layout so that the outcome is more reliable and accurate * changes to sensors and actuators and interfaces so that the outcome is more reliable and accurate * improving code so that the outcome is more reliable and accurate * justified the choice of components and systems used   Student is able to justify the choice and costs of components**.** Student is able to compare competing components, interfaces for the same purpose and justify their decisions in using one over the other.  *The examples above are indicative samples only* |

Final grades will be decided using professional judgement based on a holistic examination of the evidence provided against the criteria in the achievement standard