91891 2.2B

**Internal Assessment Resource**

**Digital Technologies & Hangarau Matihiko Level 2**

This resource supports assessment against Achievement Standards 91891 and 918941

**Standard title:**  91891 Apply conventions to develop a design for a digital technologies outcome (3 credits)

91894 Use advanced techniques to develop an electronics outcome (6 credits)

**Credits:** 9

**Resource title:** Security Systems

**Resource reference:** Digital Technologies & Hangarau Matihiko 2.2B\_2.5B

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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. |

**Internal Assessment Resource**

**Achievement Standards:** 91891 and 91894

**Standard title:**  91891 Apply conventions to develop a design for a digital technologies outcome (3 credits)

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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 standards. 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**

In this activity, students are required to:

* develop an electronics outcome that addresses concerns over security of storage containers or access to spaces
* generate and model design ideas using design conventions to address component selection, user interfaces and interfacing of input/output and power supply.

This is an integrated assessment activity supporting a project approach that assesses against two achievement standards.

**Conditions/Ngā Tikanga**

It is recommended that students should have multiple checkpoints with their teacher as they work through this assessment activity to ensure they have an opportunity to ask questions and gather feedback.

**Student evidence for assessment against** AS**91894**

Students are required to collect evidence to support judgement against the assessment criteria as they develop their electronics outcome.

**Student evidence for assessment against AS91891**

Students are required to collect evidence as they investigate conventions and then generate and model design ideas. This does not require students to produce pages of researched information. Students should be given guidance about producing a concise document or portfolio of work.

This achievement standard does not assess format or style.

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

**Resource requirements/Ngā Rauemi**

The list of resources for these standards will depend on the teaching and learning programme. As an overview, students will need access to appropriate electronics components and equipment. This could include:

* Microprocessors or *System on a Chip* along with programming cables
* Power Supplies
* Electronic components and a range of input components, sensors and output devices
* Multimeters, breadboard components, Veroboard or Kiwi Patch boards or Printed Circuit Board equipment.

Students will need access to computer with appropriate IDE’s for writing and downloading code into a Microprocessor.

Off the shelf (premade kitsets) will limit students’ ability to achieve the standard, as they will not have the opportunity to investigate and determine component selection.

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**Student/Akonga instructions**

**Introduction/Kupu Arataki**

This assessment activity requires you to develop an outcome that addresses concerns over security of storage containers or access to spaces.

You will need to generate and model design ideas to address component selection, user interfaces and interfacing of input/output and power supply.

You will be assessed on how effectively you apply conventions to develop a design for your digital outcome and on the skills and knowledge shown in the development of an 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 design document.

Teacher note: Insert due dates and timeframes

**Task/Hei Mahi**

Follow the framework below.

**Develop a design**

1. Jewellery box, desk drawer, door? Select an appropriate context for your security system. Explain the purpose of the outcome and the requirements of end users.
2. Investigate and apply relevant conventions. These could include conventions relating to: circuit schematics, scale drawings, user interface mock-ups, bread boarding. Summarise your findings.
3. Generate at least two design ideas using conventions.
   * Model these designs. This means test/check whether your ideas are feasible, check that end users understand how your system will function.
   * Select a design that meets the purpose of the outcome and explain the appropriateness of the design
   * Use feedback gained from modelling to improve the design.   
     *Present your design ideas with annotations that show feedback on your designs and improvements.*
4. Justifyhow your selected design addresses each of the following:
   * The use of appropriate conventions
   * End users considerations
   * Any use of internet information and ideas that have intellectual property issues
   * How the chosen design addresses the identified and explained implications
   * Ease of use of the interface for the end user
   * Functionality and reliability of the system
   * Sustainability and future proofing.

**Develop an electronics outcome**

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 and of high quality.

You should document 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):
   1. Analogue Inputs: Voltage, Current and Resistance characteristics and an explanation of Analogue to Digital Conversion.
   2. Switch De-bouncing: An explanation of, and techniques to resolve it within either hardware or software.
   3. Transistor behaviour and current gain and its impact on transistor selection.
   4. Servo control and an explanation of Pulse Wave Modulation.
   5. Motor control, the consequences of back EMF and an explanation of how this can be mitigated using components.
   6. H-Bridge purpose and an explanation of how to functions.
   7. 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
   1. why software code needs to meet codes of practice
   2. why the system needs to meet end-user specifications
   3. 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 – Security 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 security system.   * tested and debugged to ensure that the outcome performs to specifications   Student has shown evidence of:   * testing the input interface on expected access methods * testing the output interfaces to show locking/unlocking * modifying code beyond any template or teacher supplied code samples * explained the interfaces and functions of components and systems   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   **For example (partial evidence)**  Student describes the concept of switch debouncing and its effect on their circuit in early testing.  Student describes the operation of a Servo and a basic description of Pulse Wave Modulation to control position.   * explained relevant implications   Student explains implications that may include:   * why software code needs to meet code 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   Student has explained the behaviour and function of selected interfaces or components within their electronics outcome. For example, the student describes:   * the concept of switch debouncing and its effect on their circuit in early testing. Then explains a software solution to the issue * the function of a DC latching solenoid and then explains how a H-Bridge is able to reverse polarity to open/close the latch * the reason for a shift register when using a large quantity of tact switches for pass codes, then explains how a shift register works. * tested and modified to ensure reliability   Student is able to test and show reliability in their electronics outcome. This may include:   * Well organised breadboard layout with no loose components. Evidence that the system can function in a consistent manner in its intended location * Soldered components on a Vero board or Kiwi Patch board or Printed Circuit boards will provide 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 system.   * addressed relevant implications   Student is able to address relevant implications that may include:   * Well-structured code. The student’s 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 of components**.** Student is able to compare competing components, interfaces for the same purpose and justify their decisions in using one over the other.  **For example (partial evidence):**  “*I decided to use a Servo for the locking mechanism instead of a Motor. While there is marginal difference in cost, the level of complexity in XZY made me choose …”*  *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

**Assessment schedule/Mahere Aromatawai: Digital Technologies & Hangarau Matihiko 91891 – Security Systems**

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| **Evidence/Judgements for Achievement/Paetae** | **Evidence/Judgements for Achievement with Merit/Kaiaka** | **Evidence/Judgements for Achievement with Excellence/Kairangi** |
| Apply conventions to develop a design for a digital technologies outcome.  The student has:   * described the purpose of the outcome and the requirements of the end users   Student has chosen a specific context for the security system such as a desk drawer, cupboard, jewellery box and classroom door**.** The student then clearly explains the purpose and the end users requirements.   * investigated and explained relevant conventions   Student researches methods or examples of generating design ideas using a range of design conventions that could include circuit schematics (sketches or CAD), user interface mock-ups, scale drawing of enclosures or how the system will be placed in its intended location and explains the conventions used.   * generated and modelled a range of design ideas   Student selects and uses appropriate design conventions to generate 2 or more design ideas for the Security System interfaces (Access controls, LCD or LED indicators, Locking Mechanism).   * explained relevant implications   Student is able to explain implications that may include:   * why any use of internet information and ideas may have intellectual property issues * why the interface needs to be easy to use for the end user * why the system needs to be functional and reliable * why the system needs to be sustainable and future proof. * selected a design for the purpose of the outcome and explained the appropriateness of the design   Student selects a design idea, or selects specific interface ideas to continue developing into a functional electronics outcome.  *The examples above are indicative samples only* | Apply conventions to develop an informed design for a digital technologies outcome.  The student has:   * used feedback gained from modelling to improve the design   Student shows where feedback has been used to improve their design or the design of an interface. This may include   * teacher feedback on feasibility and component selection * further internet research on a specific interface that leads to improved design * end user feedback on the suitability of access controls and user feedback. * explained how the chosen design uses appropriate conventions   The student has explained what conventions they chose and give reasons for the selection.  **For example (partial evidence)**  *“The solution demonstrates the* Visibility of system status *heuristic by using a red and green LED to show when the system is locked or open.”*  *“The final system layout and component options were selected by developing a schematic circuit diagram to plan the system.”*   * demonstrated how the chosen design addresses relevant implications and end-user considerations   The student demonstrates that their design addresses relevant implications and end-user considerations.  **For example (partial evidence)**  *“The aesthetics requirements of the end-user of a table-top jewellery box means the lock should be hidden from view, inside the box using a RFiD, while at the same time not using up too much space inside the box.”*  *“The remote-locking garden gate needs to be manipulated easily by me, but not allow my pre-school brother egress."*  *“The lock housing must also be future-proofed to perform in a range of weather and temperature conditions.”*  *“A water-proof container is required to allow the locking system to be used in wet areas.”*  *The examples above are indicative samples only* | Apply conventions to develop a refined design for a digital technologies outcome.  The student has:   * justified how the chosen design addresses implications, end-user considerations, and uses appropriate design conventions   Student is able to justify design decisions around component selection for:   * access/authorisation * locking mechanisms   Student is able to justify how each interface will function in a way that enables the system to work reliably for the end user  **For example (partial evidence)**  *“After trialling a range of password ideas for the user interface button controls with my end-user, I decided on a 3-digit pass-code. The system functionality and quick access made it much easier for the user to remember.”*  *“Several system possibilities were considered, and a range of components were selected or discounted prior to modelling, following a comparison of different schematic circuit diagrams during planning of the system. This allowed for the most robust system to be selected, without the expense of having to trial many components.”*  *“A remote-locking garden gate mechanism is easily manipulated by me and my parents, at the same time the housing and lock mechanism is too sophisticated for my pre-school brother to use. I used a plastic sealable lock housing as the lock must be future-proofed and robust to perform in a range of weather and temperature conditions.”*  *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