National Certificate of Educational Achievement
TAUMATA MĀTAURANGA Ā-MOTU KUA TAEA

'Teach me Thy way, O Lord'

Hamilton Christian School

Year 12 Digital Technologies

Digital Technologies | Hangarau Matihiko Level 2

2.5 Use advanced techniques to develop an electronics outcome

AS91894 (6 credits) **Version 1**

Achievement	Achievement with Merit	Achievement with Excellence
Use advanced techniques to develop an electronics outcome	Use advanced techniques to develop an informed electronics outcome	Use advanced techniques to develop a refined electronics outcome

Resource title: ELECTRONICS - MONITORING SYSTEMS

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.

Conditions

The format of the final proposal is an E-PORTFOLIO of all the development, research and refinement of the student's proposal process. The format is not assessed by this achievement standard.

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

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.

Student / Akonga Instructions

Introduction

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.

Due Date: FRIDAY (Term , Week)

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.

3. 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.

4. 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.

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

12DT Assessment Schedule

2.5 (91894) Develop a digital media outcome

ELECTRONICS (4 CREDITS)		
Achieved	**Merit**	**Excellence**
Use advanced techniques to develop an electronics outcome	Use advanced techniques to develop an informed electronics outcome	Use advanced techniques to develop a refined electronics outcome

(2.5) 91894: Use advanced processes to develop an electronics outcome

Updated December 2019. As a result of trialling and verification, the following information is available to assist in the assessment of Level 2 Digital Technologies standards. Clarification documents will be further developed when sufficient material has been submitted through the external moderation process. Further assessment support can also be found on TKI.

If any information is missing look for it in once of there places as it will have been logged there somewhere (try using a keyword search with in my Repo)
https://github.com/OLLYDOTDEV/Project-Birdseye-DTX-2020/
https://github.com/OLLYDOTDEV/Project-Birdseye-DTX-2020/issues?page=1&q=

Or if you dont know how to use github i have added all to a google doc (the maybe the odd

formatting issue)
https://docs.google.com/document/d/18i7r6FDUm2NnaW7tX2osDDcfcMaJmfYflJPwUAAQ3Jc/edit#

Project overview
https://youtu.be/X6soR0ZIsdU

Implications
https://youtu.be/VuXKZyuU8Dc

1.	This standard requires students to use a programmable microprocessor. Arduino, Picaxe or other similar devices. https://youtu.be/HaekbHv2u70	
2.	Examples of advanced techniques are given in Explanatory Note (EN) 3. These provide guidance about the level expectations and are not an exhaustive list. Assessors may need to determine other techniques that are advanced. Students need to demonstrate at least two advanced techniques in their electronics outcome. EN3. Examples of advanced techniques may include: • using embedded software • subsystem level design Architectural Design plan Detailed Design level of each part (also has with init how they work together) • remote control In short Wifi, NRF24 was used for more info see these three dev logs https://github.com/OLLYDOTDEV/Project-Birdseye-DTX-2020/issues/16 https://github.com/OLLYDOTDEV/Project-Birdseye-DTX-2020/issues/17 https://github.com/OLLYDOTDEV/Project-Birdseye-DTX-2020/issues/30 • advanced printed circuit board (PCB) development • data storage (EEPROM) While EEPROM wasnt used Forms of data used are - Flash memory (SD card for RPI, atmega chip - used to store ROMS.ino code for the arduino)non-volatile there for good for strong data while powered off - SRAM (where variables and sketch can be manipulated/ run) volatile there for loss of power = info wiped. • analogue to digital conversion (ADC). ADC is found with reading my IR sensor, ADC converter chip that embedded into the IR sensor failed to give me accurate results by using my own ADC converter I was able to manually define what was counted as a high or low for in-depth explanation see https://github.com/OLLYDOTDEV/Project-Birdseye-DTX-2020/issues/14#issuecomment-649520131	
3.	Students need to **explain** the relevant implications for the electronics outcome. This could be used to inform the design and development of the outcome. See meaning of Relevant Implications.	

4.	Students need to explain the interfaces and functions of the components and systems used. Interface: RPI - INFO - GPIO - Wifi - USB - NRF24 wireless - Apache web interface ROMS - INFO - IR sensor - PIR sensor - USB ttl serial - NRF24 wireless - Serial port Evidence of modifying and debugging is required. Examples are provided in EN4. EN4. Examples of testing, modifying and debugging include: • using testing devices and testing strategies Structural Testing Strategy + Test-driven development what was mainly used where known hardware and a set desired output was taken and the code as ittertraded until the toad for the test conditions were met. Eg I am expecting X output then the hardware/softwate is changed until the expected output it achieved This can be seen with IR Sensor - summary of IR sensor is i wanted to be able to detector value at 6cm from the sensor. So the Test is what config of software/hardware would give me any sort of reading. In the end I found some configs that depending on the environment was able to detect 4cm to around 30cm ish. Thjs also led to some Behavioral Testing where the tests that was conducted to see to what extent the IR sensor can be push, eg(different lighting situations, different surfaces to reflect their IR light off) • testing expected, boundary and invalid inputs https://youtu.be/lkk4JO5-xGo • changing board layout Reading from here down to the end of the page should cover everything you need to know for this https://github.com/OLLYDOTDEV/Project-Birdseye-DTX-2020/issues/6#issuecomment-643741177	

	• improving component selection. Read from https://github.com/OLLYDOTDEV/Project-Birdseye-DTX-2020/issues/6#issuecomment-643721353 Then read the next four comments To here https://github.com/OLLYDOTDEV/Project-Birdseye-DTX-2020/issues/6#issuecomment-643727247 This should improving component for MOSFET's There is also power Regulators is another good example. https://github.com/OLLYDOTDEV/Project-Birdseye-DTX-2020/issues/8#issuecomment-643705732 While this process was done for most parts these are the main ones that stand out	
5.	For **Merit,** students need to identify the **behaviour and function** of the outcome. This will include an explanation of **what** the outcome does and **how** components work together to make this happen. **behaviour and function** https://github.com/OLLYDOTDEV/Project-Birdseye-DTX-2020/blob/master/README.md https://docs.google.com/spreadsheets/d/16NvosoglUdbh59W8HpK1O01PnWvv-FwU3_pFYV_oCNE/edit#gid=1414830219&range=A1:Q1 Also see https://youtu.be/MECe7MJ_z0Y	
6.	They also need to evaluate the components and systems used. Every component for the system was evaluated to give what provides the most value to the user as well what will need to be done for the sub system to achieve the desired outcome of that system. eg https://github.com/OLLYDOTDEV/Project-Birdseye-DTX-2020/issues/29#issue-680976291 https://github.com/OLLYDOTDEV/Project-Birdseye-DTX-2020/issues/6#issue-633187073 https://github.com/OLLYDOTDEV/Project-Birdseye-DTX-2020/issues/17#issue-637587040 https://github.com/OLLYDOTDEV/Project-Birdseye-DTX-2020/issues/17	

	That is just a small handful of random examples that I grabbed i have a 26 more And there are just found in the first comment of each github issue. As github issue/ project board was used to keep track of each components and there related information	
7.	Students also need to show how they've addressed the relevant implications.	
8.	A student will also need to provide evidence of how their electronics outcome was made more reliable using testing and modifying. The student could use annotated images or video. read https://github.com/OLLYDOTDEV/Project-Birdseye-DTX-2020/issues?q=+label%3A2.5+	
9.	For **Excellence,** iterative improvement is required throughout the design, development and testing process. Iterative improvement will involve cycles of improvements. A working outcome is required for Achieved.	
10.	For Excellence, the student should use a cyclic process to develop improved outcomes. Used a sprint release cycle system for this as it. Eg Plan what is going to be added Added it Check that it works(test) Review is it what was wanted Repeat Also best attempts which made to try to follow the agile principles See github for more	
11.	Students need to justify the choice of components and systems used. There is a dedicated clarification that expands on what is meant by iterative improvement. While i only started latter into the development with sprint Cycles with at the end of each cycle having the aim of having a workout outcome with the addition improvement to the functionally	

	https://github.com/OLLYDOTDEV/Project-Birdseye-DTX-2020/milestones?state=closed Otherwise just there is also incremental development as seen here https://github.com/OLLYDOTDEV/Project-Birdseye-DTX-2020/commits/master	

Iterative improvement

Updated December 2019. This is a new document to address issues that have arisen from moderation.

12.	For Excellence in (2.3) 91892, (2.4) 91893, and (2.5) 91894, iterative improvement requires that students develop a functional outcome using documented cycles of improvement. This may include adding features to the outcome.	
	This needs to be shown through deliberate cycles of improvement based on testing and trialling rather than just incremental development.	
	Iterative improvement is more than just debugging or correcting errors in a non-functioning outcome. It is expected that the student will produce a functioning outcome for an Achieved grade.	
	Iterative improvement should be **aimed at making a better product.** This evidence needs to be provided for moderation.	
	Students may be able to provide sufficient evidence of the development of the outcome using, for example, annotated screenshots, ‘commit’ messages, commenting within the source files of the outcome. They may not need to submit all the previous versions of the outcome.	

Relevant implications

Updated December 2019. This is a new document to address issues that have arisen from moderation.

https://youtu.be/VuXKZyuU8Dc

1.	The criterion at level 2 requires students to 'explain' relevant implications (as opposed to 'describe' at level 1).	
2.	**'Explain'** requires some documentation. For example, a student might explain issues related to privacy when storing personal information in their database.	
3.	A student should identify and explain the implication. They explain how the implication applies to the outcome. They should explain what the outcome needs to do or to include to meet the implication.	
4.	The explanation of the relevant implications should be done in the early part of the design or development process so that the implications explained are used to inform the design/development of the outcome.	
5.	**'Address'** may be evident from naturally occurring evidence, for example the use of ALT tags, or might be given in documentation. For example, students may indicate that they have chosen colours which make a website accessible for colour-blind end users.	
6.	Quality, rather than quantity, is important. Assessment should not be based on the number of implications, but on how well they have been explained and on how effectively they have been addressed.	

EXPLANATORY NOTES 2.5

1 *Use advanced techniques to develop an electronics outcome* involves:
- using appropriate resources and techniques to develop a functional electronics outcome
- Testing and debugging to ensure that the electronics outcome performs to specifications
- Explaining the interfaces and functions of components and systems
- Explaining relevant implications

Use advanced techniques to develop an informed electronics outcome involves:
- Identifying the behaviour and function of the electronics outcome
- Testing and modifying to ensure reliability of the electronics outcome
- Evaluating the choice of components and systems used
- Addressing relevant implications

Use advanced techniques to develop a refined electronics outcome involves:
- Undertaking iterative improvement throughout the design, development and testing process to produce a high-quality electronics outcome
- Justifying the choice of components and systems used.

3 Examples of advanced techniques may include:
- using embedded software
- subsystem level design
- remote control
- advanced printed circuit board (PCB) development
- data storage (EEPROM)
- analogue to digital conversion (ADC).

4 Examples of testing, modifying and debugging include:
- using testing devices and testing strategies
- testing expected, boundary and invalid inputs
- changing board layout
- improving component selection.

5 Examples of relevant implications include:
- social
- cultural
- legal
- ethical
- intellectual property
- privacy
- accessibility
- usability

- functionality
- aesthetics
- sustainability and future proofing
- end-user considerations
- health and safety.

Overall Grade:	**Achieved**		**Merit**		**Excellence**	