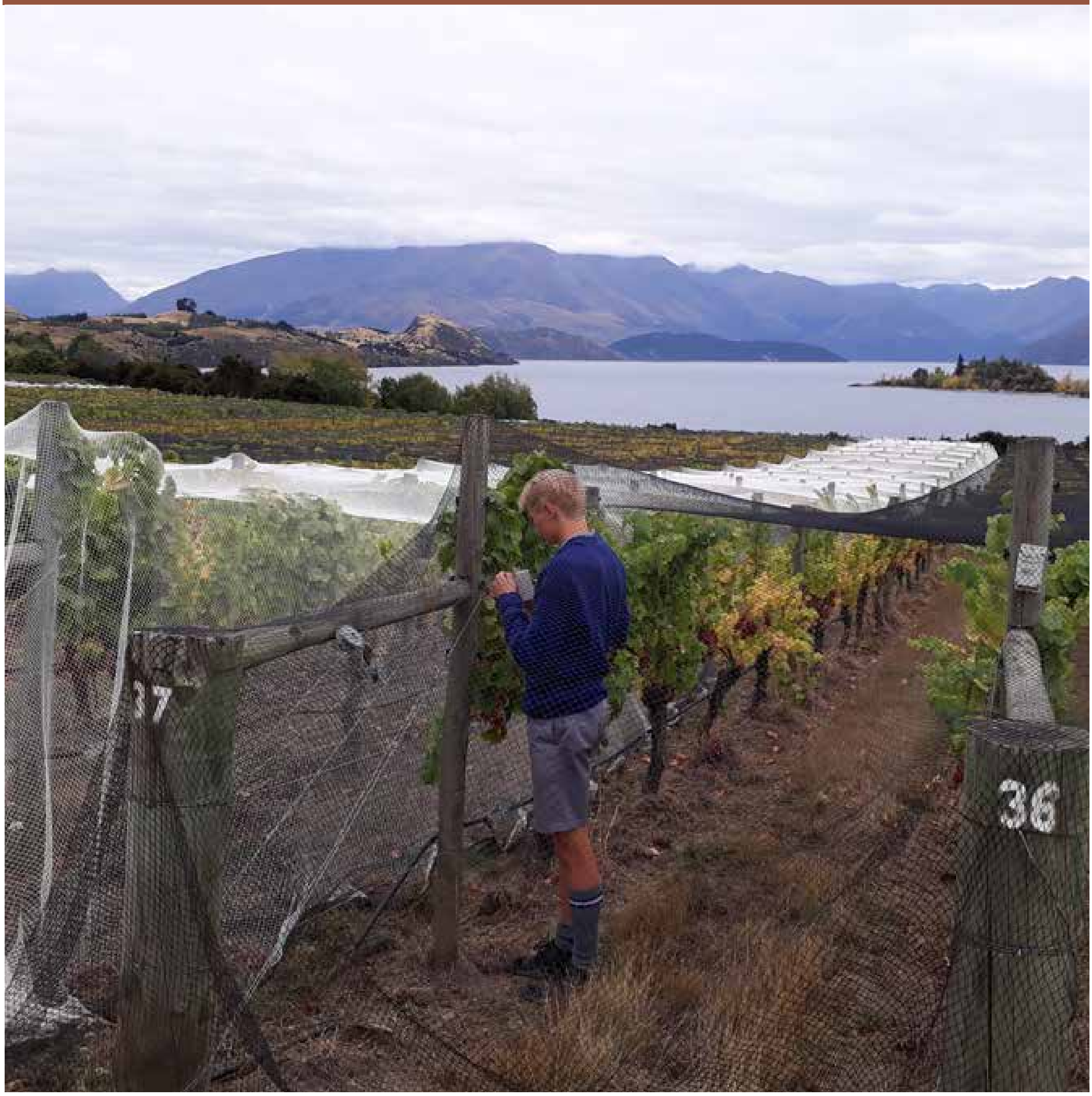
Digital Technologies | Hangarau Matihiko

Level 6 – New Zealand Curriculum

Teaching and learning programme

Electronics: Native plant monitoring



MINISTRY OF EDUCATION
TE TĀHUHU O TE MĀTAURANGA

Developed by Craig Jefferies, Mt Aspiring College 2017

The full teaching and learning programme resources, associated materials and an assessment task will be supplied in 2018.

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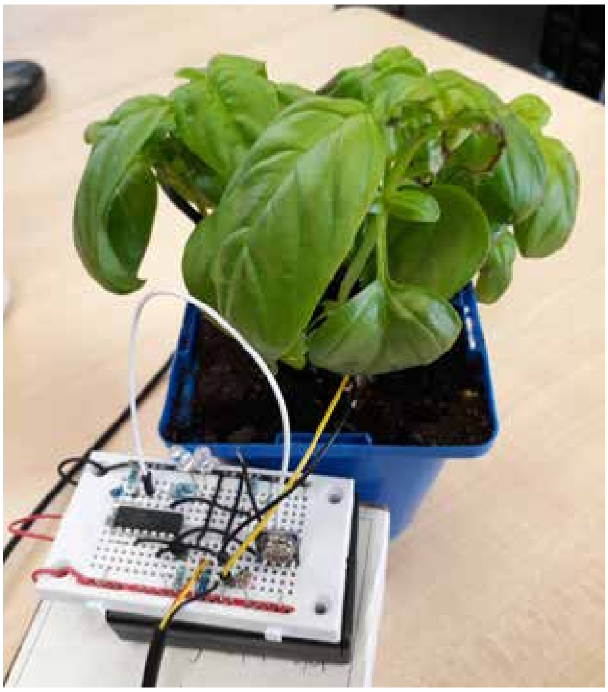
Summary

This teaching and learning programme focuses on developing an electronics outcome suitable for monitoring the environmental conditions of plants to enable plant health and survival. Students will engage in a broad range of knowledge and skills in digital technologies.



By the end of this teaching and learning programme, students will be able to:

Apply knowledge and skills to develop an electronic environmental monitoring system capable of measuring a range of environmental conditions including: air temperature, soil temperature, soil moisture, and light. This will provide valuable information to the user, such as soil moisture, soil temperature, and warning indicators.

Duration (terms, weeks, teaching periods)

40 plus hours of teaching and assessment: approximately 9–10 weeks or one full term

Key teaching and learning concepts – the big ideas

Electronics: identification and interfacing of electronic components, analogue and digital inputs, embedded software programming, and DC circuit theory

Alignment to NZC and/or Te Marautanga

DTHM – Designing and Developing Digital Outcomes (DDDO)

- Learn about the way electronic components and techniques are used to design digital devices
- Become increasingly skilled in integrating electronic components and techniques to assemble and test an electronic environment

Links to other learning areas

This programme links to:

- Physics: related to direct current(DC) circuit theory
- Science: investigating linear relationships and conducting fair tests, for example, the effect changing soil moisture has on electrical resistance of soil
- Science: plant propagation and the effects of environmental conditions and soil types on plant growth.
- Ag & Hort: plant progagation and cultivation

Teaching and learning pedagogy

Problem-based learning: students are given a problem to solve. This forms the context for a unit of work around the development of an electronics outcome.

Prior knowledge/place in learning journey

Level 5 numeracy and literacy skills are the main prior knowledge needed. A passion for building, constructing, and making and some previous experience in computer programming or electrical circuits would be an advantage.

Resources required

A range of electronic input and output components, including a suitable battery-powered microprocessor. A PC capable of running programs needed to download software to a microprocessor.

- Microprocessor: PICAXE, Arduino microprocessor or similar
- Electronic components: 330, 470, 1K, 10K, 4K7 resistors. LDR's and 100K NTC thermistors. BC337 transistors, tact switches, P9000 motors, 5mm LED's, piezo buzzers, DS18B20 digital temperature sensor, Dorji ASK Rx and Tx modules

A more comprehensive list can be found within the guide.

How you might adapt this in your classroom

A key focus of this teaching and learning is the opportunity for monitoring environmental areas suitable for planting, beyond the four walls of the classroom.

If this is not an option, an idea for within the class could be:

- Keep it alive: giving each student a potted herb plant to monitor and "keep alive" over the term.

Assessment

AS91881 (1.5) Develop an Electronics Outcome (6 credits)

- Portfolio Based Assessment Practices. Techniques for use of Google Classroom to facilitate and submit student portfolios
- Clarification of student evidence requirements for AS1.5
- Clarification of Judgement statements for Achieved, Merit, and Excellence

Term outline

The Learning context:

What is being covered	Approximate duration	Specific Learning Outcomes Students will be able to:	Learning Activities
Basic Input/output concepts	Weeks 1 and 2	• Interface a range of output components to a microprocessor • Interface a range of analogue and digital input components to a microprocessor • Use a transistor to control larger devices, such as motors	• Set up workspace needed to interface and program an electronics outcome • Interface outputs such as 5mm LEDs and buzzers • Write and modify software code to control outputs • Interface inputs such as switches, resistive sensors such as LDRs, 100K NTC thermistors and moisture sensors. Write software to monitor analogue inputs in a serial terminal • Interface a transistor switch sub-system to control a motor.
DC circuits, circuit subsystems, symbolic conventions and schematics Embedded software conventions	Week 3	• Apply knowledge about DC circuits in practical contexts • Apply software conventions to construct logical and robust programs	• Understand concepts of DC circuit theory including voltage, current and resistance within series and in parallel • Recognise electronic components and use these to draw circuit schematics • Learn and apply software conventions including variable and constant declaration, use of subroutines, and conditional statements (if used)

The Learning context *(continued)*:

What is being covered	Approximate duration	Specific Learning Outcomes Students will be able to:	Learning Activities
Trial and test an electronic system with analogue input	Week 4	• Construct multiple interfaces to monitor and provide feedback to user • Undertake trailling and testing of electronic systems	• Construct circuits that use both input and output subsystems to collect input and make decisions • Undertake testing of analogue inputs on expected conditions and use these tests to modify and improve an electronic system • Undertake trailing of an electronic system in a range of conditions to improve reliability
Transistor subsystem, series resistors, and voltage divider, RF components	Week 5	• Apply knowledge of a range of electronic subsystems into practical contexts	• Explain the behaviour of a range of subsystems within practical contexts. – LED and series resistor – LDR or thermistor in voltage divider • Investigate radio components and serial communication protocols for sending data packets
Assessment	Weeks 6–9	• Complete assessment task	• Engage in assessment