ARAT Detailed Course Outline - DRAFT

CASE 4 Learning Detailed Course Outlines contain the Core Concept the student will understand upon completion of the lesson and the performance objective stating what the student will do to demonstrate understanding. The number designates the concept, and the underlying bullet is the corresponding performance objective. Because this course is in development, not all performance objectives have been identified.

Unit 1 Foundations of Ag Automation

Lesson 1.1 Data Collection

1. Agriculturalists use electrical, communication, and embedded software to collect data.
    - What are the different electrical components used, such as board/wires.
2. Electrical systems use resistors, diodes, potentiometers, and relays to control equipment components.
    - Design and construct a circuit to control motor speed and direction.
3. Ag producers collect data with sensors used for actionable insights.
    - Examine types of sensor inputs and outputs.
4. Agriculturalists transfer, collect, and store data for production decisions.
    - Identify how the farm transfers data into the cloud for further analysis.
5. Machines compile data to complete tasks in ag production and processing.
    - Investigate how sensors collect data and how embedded software uses sensors.

Lesson 1.2 Data Insights

1. Automation and data technologies are used by those involved in animal, plant, and food production.
2. Producers leverage data insights to enhance production and management decisions.
3. Telematics connects the grower, machine, and crop into a cloud-based, data-driven environment.
    - Students will utilize RFID tracking to monitor the locations of equipment.
    - Students will use remote monitoring systems to track equipment location and performance and notify of service schedules.
4. Artificial intelligence, automation software, and data analytics analyze data visually to make management decisions.
    - Identify what type of data is A.I. driven, static data, algorithm data, analytics.
    - Objective (Activity 1.2.5)
5. Implementing technology and automation in food, fiber, and fuel production requires considering many technical, physical, and psychological (stress) factors.
    - Identify possible stress factors with technological implementation.
    - Objective (Activity 1.2.6)

Lesson 1.3 Acting on Data

1. Automation involves a team of engineers, technicians, and tradespeople.

2. Employees and technicians employ multiple redundant safety measures for a safe working environment.
3. Agriculture uses traceability as a biosecurity measure in animal, plant, and food systems.
4. Programmers use Boolean logic to program P.L.C.s for machine operation. (MSA 4.2)
    - Use Boolean logic to program a virtual robot to navigate boundaries and obstacles. (Activity 1.3.4)
5. Technicians manage and troubleshoot controller systems.

Unit 2 Automation in Plant Systems

Lesson 2.1 Soil Health

1. Soil testing provides data for management related to soil and plant health.
2. Farmers and agronomists use soil analysis to create crop fertilizer prescriptions throughout the production cycle.
3. Ag producers use GPS/GIS to improve production agriculture accuracy, resource management, and yields.
4. Actionable insights include measurable data, which assists with decision-making.

Lesson 2.2 Plant Growth

1. Technology can assist with monitoring plant growth.
2. Digital imaging can be used to identify plant growth stages.
3. Sensors can monitor plant growth and calculate growing degree to gauge a plant production schedule.
4. Transducers are utilized to collect data, which allows producers to make decisions throughout plant growth stages.
    - Objective (Activity 2.2.4)
5. Agricultural producers use technology to identify and control crop pests.
6. Agricultural producers use technology to identify and control crop diseases.

Lesson 2.3 Harvest

1. Ground-drive automated equipment relies upon G.P.S. mapping and G.I.S. utilization.
2. Automated systems enhance efficiency, quality, and speed and ensure timely, safe delivery of crops to storage in post-harvest processing
3. Sensing devices can provide needed information for harvesting decisions.
4. Harvest data is collected with transducers for actionable insights.
5. Grain elevators have automated systems of conveyors, bulk elevators, and augers connected to move bulk commodities

Unit 3 Automation in Animal Systems

Lesson 3.1 Animal Health

1. Radio-frequency identification (RFID) is used by professionals and animal owners to identify animals.
    - Construct a low-frequency RFID scanner to simulate LF ear tag and microchipping technology. (Activity 2.1.1)
2. Automated systems record, monitor, and analyze animal health.

3. Animal health professionals use insights from data to make animal health decisions.

Lesson 3.2 Animal Management

1. As the livestock industry varies across different regions in the country, so does the technology that is relevant and available.
2. The implementation of automation in animal systems requires adaptations by both the animals and the producer.
3. Automated systems can accurately deliver food to all animals.
4. Producers equip livestock facilities with automated climate control systems.
5. The producer uses the insights from the data to make improved management and production decisions.
6. Producers manage livestock reproductive systems using IoT technologies.
7. Understanding a realistic timeline for the implementation of animals adapting to technology.

Lesson 3.3 Animal Production

1. Automated systems can monitor animal welfare.

Unit 4 Automation in Food Systems

*To de developed in 2026

Unit 5 Automation Solutions

Lesson 5.1 Engineering Design Process

1. Engineers document criteria, constraints, design solutions, and results as part of the engineering design process.
    - Prepare an engineering notebook and investigate an engineering design problem for planting soybeans.
2. Intellectual product protection includes patents, trademarks, and copyrights.
    - Collect and summarize research about similar problems with patented, copyrighted, or trademarked solutions.
3. Engineers design agricultural solutions to improve efficiencies.
4. Design new agricultural equipment improving agricultural production or processing.
5. Results of engineering projects include interpretation of data in the form of posters, papers, or oral presentations.
    - Write a technical report summarizing an engineering design.
    - Prepare a research poster to present to the class and at local science and engineering fairs.
6. Animal, plant, and food systems professionals use automation and data technologies.
7. Results of engineering projects include interpreting data in the form of posters, papers, or oral presentations.
    - Research organizations that regulate new product designs.
    - Write a user manual for a new product design.