Farm Robotics
Educator Guide for the Farm360 Video

Overview:
The Farm Robotics 360 experience provides an overview of one way that technology can provide a creative solution for farmers. Farmers, designers, and engineers have worked together to increase productivity and efficiency as it became clear that milking a cow by hand could no longer keep up with the demand for milk. By combining advanced technology with more flexibility and data collection, Automatic Milking Systems allow farmers to not only increase milk production, but also to improve their animal husbandry for healthier cows.

Objectives*:*
- Students will be able to describe how the Automatic Milking System technology is an innovative solution for farmers by summarizing the challenges with traditional cattle milking practices.
- Students will be able to explain why the Automatic Milking System technology can make farmers more efficient and effective by analyzing the information in the *Farm Robotics* 360 experience.

Boot up (pre-activity)
Distribute the capture sheet. Draw a line on the board and label one end "0" and the other end "25". Allow students to guess the amount of milk, in gallons, produced by a cow every day. If technology is available, teachers can set-up a Google Form or use a free poll website to gather this data and instantaneously project the results to students. Once students have contributed their ideas, share that on average, dairy cows are milked two to three times per day and produce six to seven gallons of milk each day. It takes about 10 to 15 minutes to a milk a dairy cow by hand. When using a robotic milking system in a milking parlor, it takes about 5 minutes per dairy cow. Direct half of the class to calculate how long it would take a farmer to milk 100 dairy cows by hand. Direct the other half of the class to calculate how long it would take a farmer to milk 100 dairy cows using a milking parlor. Have a student share their calculations and ask them to summarize how this technology is effective using evidence from their calculations.

Experience (during)
Using the capture sheet from Boot up, students will take notes by completing the graphic organizer as they move through the *Farm Robotics* 360 experience. There are two sections for students to record their observations. First, students should use the analogy sentence starters to analyze the technologies found in the milking parlor. Students will compare a technology they are familiar with to one they will identify and observe in the 360 experience. Then, students will use the second column sentence starters to evaluate and summarize the technologies they observed in the 360 experience.

Reorient and Download (reflection and post-activity)
Two activity options are available for students to apply and summarize their learning.

Reorient #1: In groups of 2, have students develop a one or two sentence summary to the answer each of the 4 questions listed on the capture sheet. Then, have each group pair up with another group to share their summaries for each question.

Reorient #2: Hang one poster for each of the 3 sections of the graphic organizer around the room. You may need to have multiple posters for each section depending on your class size. Divide students into groups of 4 and provide each group with a different colored marker. Assign each group to a poster and give them 3-5 minutes to summarize their notes on the poster in complete sentences. Continue having the groups rotate to the next two posters; summarizing their notes at each poster. When they have completed the rotation to each poster, have each group rotate one more time through so they can read other groups responses. At the end, have students summarize the main ideas using the letters MILK on the capture sheet.

Optional: Level-up (extension)

Instruct students to read about each of the 4 careers listed on the capture sheet and explain how they would contribute to the design, build, or analysis of the automatic milking system.

National Standards

Science	HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.*
Technology Education	- Agriculture includes a combination of businesses that use a wide array of products and systems to produce, process, and distribute food, fiber, fuel, chemicals, and other useful products. - The engineering design and management of agricultural systems require knowledge of artificial ecosystems and the effects of technological development on flora and fauna.
Common Core State Standards: Mathematics	CCSS.MATH.CONTENT.HSN.Q.A.2 Define appropriate quantities for the purpose of descriptive modeling.
Common Core State Standards: English Language Arts	CCSS.ELA-LITERACY.W.9-10.1.C Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.

Boot up:

1. Estimate the amount of milk in gallons produced by a cow every day.

2. Calculate the amount of time required for a farmer to milk a dairy cow.

Milking by Hand	Milk Parlor
_____ minutes to milk a cow by hand	_____ minutes to milk a cow using a milking parlor
_____ number of minutes to milk 100 cows by hand	_____ number of minutes to milk 100 cows using a milking parlor

3. Do you think the robotic milking technology in a milking parlor is effective?

4. Can you brainstorm ways to continue to improve this technology?

Experience: Complete the graphic organizer below by taking notes as you move through the *Farm Robotics* 360 experience.

Exploration of Automatic Milking System	Evaluation of Automatic Milking System
Video streaming services personalize recommendations by _____, just like the **Automatic Milking System** _____.	I observed farmers using innovative solutions by _____.
Fitness trackers help us _____, just like **mobile apps on the farm** _____.	Innovations help farmers work more efficiently because _____.
Navigation apps help us _____, just like the **digital responder** _____.	I expected to see _____ but instead _____.
Facial recognition software _____, just like the **robotic milker** user's lasers to _____.	I was really surprised when _____.
	This 360 experience relates to the things we have been learning in class because _____.

Reorient #1: In groups of 2, develop a one or two sentence summary to the answer each of the 4 questions listed below.

Question #1: Describe the behaviors of the cow.

Question #2: Describe the benefits and the outcomes of utilizing an Automatic Milking System on the farmer.

Question #3: Explain the data collected by the Automatic Milking System.

Question #4: Describe how technology plays an important role in this innovation.

Now, pair up with another group and share your summaries for each question.

Reorient #2: In groups of 4, summarize your notes for each section of the graphic organizer in complete sentences on the posters around the room. You will contribute your ideas to each poster and then rotate one more time to read other groups' responses. At the end, you will summarize the main ideas using the letters below.

M _____

_____

I _____

_____

L _____

_____

K _____

_____

Optional: Level-up (extension): Read about each of the 4 careers listed below and explain how they would contribute to the design, build, or analysis of the Automatic Milking System.

Career	Contribution to the Automatic Milking System
Herd Manager- *Ensures that the dairy cattle are well cared for, so they can produce high quality milk.*	
Nutritionist- *Ensures that the dairy cattle are receiving excellent nutrition that allows them to produce a sustainable amount of quality milk.*	
Agricultural Engineer- *Develops new technology to help farmers be more effective and efficient.*	
Agricultural Statistician- *Collects farming data to share with state, university, and government agencies.*	