Self-Defense Monitoring Station

Lesson Plan Overview

Grade Level	**4-6 (Adaptable)**
Time Required	**2-3 class periods (45-60 minutes each)**
Subject	**STEM, Physical Science, Coding, Safety Systems**

→ Learning Objectives

1. Design and build a self-defense monitoring station using a micro:bit, ultrasonic sensor, and infrared sensor.
2. Program the system to detect proximity and motion, triggering an alarm when certain thresholds are met.
3. Explain how the ultrasonic sensor, infrared sensor, and buzzer work together to create a security system.
4. Connect the project to real-world applications of security technology in protecting valuable equipment.

→ Materials

• Smart Science IoT: Kit	Includes components needed to build the monitoring station.
• Computer with internet access and MakeCode	For programming and code execution.
• Ultrasonic sensor	Measures proximity and detects intrusions.
• Human infrared (IR) sensor	Detects motion within a designated range.
• Onboard buzzer	Emits a sound alert when a potential threat is detected.

5E Model Lesson Plan

Engage

Activity	Key Focus
Discuss the importance of security systems in protecting equipment and ensuring safety.	Building awareness of the role of technology in safety and security.
Introduce the idea of a self-defense system for monitoring stations placed outdoors.	Highlighting real-world challenges and how technology can mitigate risks.
Present the challenge: Design and build a self-defense monitoring station that triggers a sound alert when movement or proximity is detected.	Inspiring engagement through a tangible and relatable problem-solving task.

Explore

Activity	Key Focus
Provide students with the IOT:kit, including the ultrasonic sensor, IR sensor, and onboard buzzer.	Promoting teamwork and exploration of the components.
Guide students to explore the connection points and how the sensors interact with the micro:bit.	Encouraging hands-on discovery to understand the functionality of each component.
Have students experiment with connecting the sensors and buzzer to the micro:bit to test basic functionality.	Building a practical understanding of hardware integration and troubleshooting.
Allow groups to share observations, discussing how the sensors and buzzer could work together for an effective system.	Enhancing communication and collaborative problem-solving.

Explain

Activity	Key Focus
Facilitate a group discussion where students share their initial findings and challenges.	Reflecting on hands-on exploration to reinforce understanding.
Introduce/review key concepts: Sensors (ultrasonic, IR), outputs (buzzer), microcontrollers (micro:bit), and programming logic.	Providing foundational knowledge for designing an effective security system.
Explain how the IR sensor detects motion, the ultrasonic sensor measures proximity, and the buzzer signals a potential threat.	Highlighting the science and technology behind the self-defense system.
Demonstrate how these components interact through coding and circuit integration to create a functional security system.	Bridging theoretical knowledge with practical application for deeper comprehension.

Elaborate

Activity	Key Focus
Guide students step-by-step in assembling their self-defense monitoring stations, ensuring proper connections between the sensors, buzzer, and micro:bit.	Applying theoretical knowledge to create a functional prototype.
Introduce students to the MakeCode programming environment, including the necessary extensions for the IOT:kit.	Building coding skills and confidence in using the programming environment.
Help students write a program to:	
- Continuously monitor proximity using the ultrasonic sensor.	Teaching how to use sensor data to trigger system responses.
- Detect motion using the IR sensor.	Integrating multiple sensors into a single system.
- Trigger the buzzer when motion or proximity criteria are met.	Demonstrating conditional logic and real-time decision-making in coding.
- Adjust parameters for sensitivity and alarm duration.	Encouraging customization and optimization of the system.
Encourage troubleshooting and iteration as students refine their systems.	Developing critical thinking and resilience through collaborative problem-solving.

Evaluate

Activity	Key Focus
Have groups test their self-defense monitoring stations in simulated scenarios, observing their ability to detect movement and proximity accurately.	Assessing functionality and effectiveness of the devices.
Encourage students to reflect on their learning by discussing:	
- Challenges they faced and how they overcame them.	Promoting self-assessment and resilience in problem-solving.
- Improvements they could make to their system.	Inspiring creativity and iterative design.
- Insights gained about the importance of security systems in various environments.	Reinforcing the relevance of their work to real-world applications.

Assessment Criteria

Criteria	Details
Participation	Active involvement in group discussions and activities.
System functionality	Proper assembly and working of the self-defense monitoring station.
Programming skills	Accurate and effective use of MakeCode to program the micro:bit.
Concept understanding	Comprehension of sensors, outputs, microcontrollers, and automation principles.
Creativity and problem-solving	Innovative approaches to building and testing the system.

Differentiation Strategies

Strategy	Details
Scaffolding	Offer varying levels of support for coding and building tasks.
Alternative materials	Provide substitutes for components if necessary.
Task complexity	Adjust programming challenges based on student skill levels.
Flexible presentations	Allow students to showcase their work in multiple formats (e.g., demonstration, video).

Extension Activities

Activity	Details
Real-world research	Investigate real-world applications of self-defense systems in various environments.
System enhancements	Add features such as visual alerts or wireless notifications.
Advanced programming	Explore additional features and programming concepts using the IOT:kit.
Awareness campaign	Create a presentation or video showcasing the importance of security systems and their device.

Teacher Notes

Note	Details
Safety	Ensure students handle tools and materials safely.
Instructions	Provide clear steps for assembly and programming.
Support	Offer guidance during hands-on activities.
Collaboration	Encourage teamwork and collective problem-solving.
Real-world connection	Emphasize the relevance of the project to real-life security challenges.