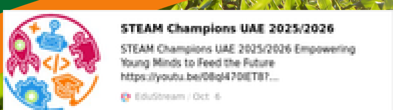
PBL
PROJECT BASED LEARNING

STEAM Champions Competition
2025-2026



This competition is aligned with SDG 2 – Zero Hunger, as it encourages students to design innovative, technology-driven solutions that improve food security, reduce wastage, streamline production processes, and contribute to healthier, more sustainable communities.

INTRODUCTION

The **STEAM Champions Project-Based Competition** is designed to empower students from **KG to Grade 12** to become real-world problem solvers through hands-on innovation aligned with the global theme of **Food Security**.

What Students Explore

By blending:

- *Creativity*
- *Engineering*
- *Sustainability*
- *AI & IoT*

students explore how food is **grown, protected, monitored**, and **sustained** in a rapidly changing world.

> **NOTE**: Students are expected to present a fully functioning working model along with a supporting presentation. A foam board or project-relevant poster must also be displayed to explain their concept clearly.

Students participate through three clearly structured levels:

Explorers (KG–2)	Innovators (Grades 3–6)	Challengers (Grades 7–12)
Simple, playful, sensor-based plant care activities.	*Intermediate projects using basic circuits, sensors, and simple automation.*	*Advanced smart farming prototypes, renewable energy models, and AI-driven crop monitoring.*

What This Guidebook Provides

This guidebook helps teachers confidently guide students through meaningful, future-ready STEAM learning that connects technology to one of humanity's most essential needs - ensuring healthy, sustainable food for all.

SECTION 1: EXPLORERS (KG–GRADE 2)

Theme: Where food comes from

Young learners use stories + simple logic blocks to understand how food grows, stays fresh, and is protected.

ADVANTAGES

- *early awareness of food security through play & stories*
- *logical thinking with simple sensors*
- *responsibility and care through plant-based activities.*
- *boosts confidence with easy, success-driven projects*

PROJECT 1

MAGIC PLANT WATER REMINDER

Concept Plants need water regularly. A distance sensor reminds the plant ("Piku") to stay close to the water source.

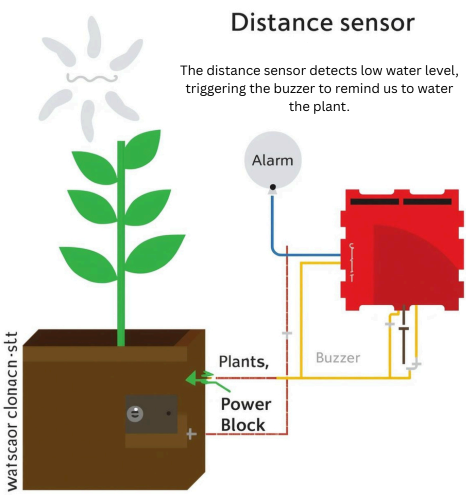
Materials Explorer competition kit - Power Block, Distance Block, Buzzer/LED, paper cup plant (Piku), Water Station cup.

BUILD

Power → Distance → Buzzer/LED (in a straight line)

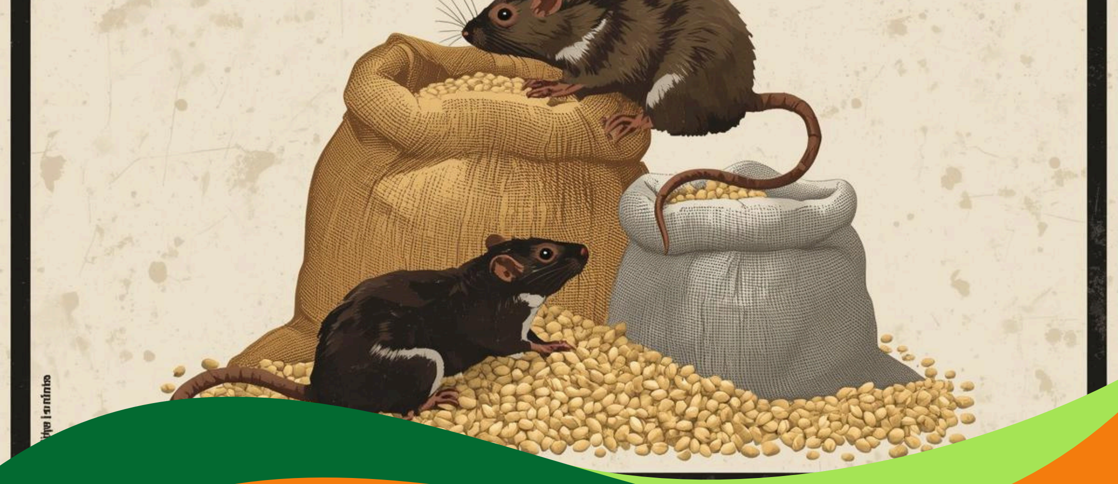
How it works

- Piku near water → quiet/happy
- Piku far → buzzer/LED alert ("Come back to water!")



Learning Outcomes

- Plants need water to grow
- Machines can help farmers
- Simple cause–effect understanding



PROJECT 2

RAT ALERT IN FOOD STORAGE

Concept Protecting stored food prevents wastage.

Blocks Power + IR Sensor + Buzzer

How it works

If something crosses the IR “door”, the alarm rings → simulates rats entering storage.

LEARNING OUTCOMES

- *Food loss = less food for people*
- *Sensors protect food storage*

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PROJECT 3

FOOD FRESHNESS ALARM

Concept Fridge/box opening alerts help keep food fresh.

Blocks Power + IR + LED + Buzzer

How it works

Opening lid → triggers LED/Buzzer = “Don’t waste food!”

LEARNING OUTCOMES

Keep food sealed

Fresh food prevents hunger

PROJECT 4

MICROGREENS IN A JAR (NON-ELECTRONICS)

Radish/mustard microgreens grown in transparent jars.

SKILLS

- *Care*
- *Observation*
- *Plant growth basics*

JUDGING CRITERIA

Criteria	Excellent (20)	Very Good (15)	Good (10)	Developing (5)
1. Understanding & Application of Concepts *(Science + Real-World Problem SDG-2 Zero Hunger)*	Demonstrates deep understanding of the problem and applies science concepts accurately to create an effective solution. Shows clear real-world alignment (food, water, plants, security, etc.).	Demonstrates accurate understanding of most concepts and applies them appropriately to the project. Real-world purpose is present. Solution practical and effective with minor gaps.	Shows partial understanding of concepts; application may be incomplete or somewhat inaccurate. Real-world connection is unclear, partially effective solution.	Shows little or no understanding; solution does not relate to the real-world problem.
2. Technical Build & Innovation *(Research, Hardware + Coding + Creativity)*	Well researched project. Build is stable, logical, error-free; wiring is precise, neat and stable. Coding works flawlessly, easy to read; incorporates creative improvements, sensors, or features beyond basic requirements.	Attempts testing & research. Working build with minor flaws; code works mostly as intended; includes some creative elements.	Minimal research, limited testing. Build functions sometimes; several technical errors; small component issues affect reliability. Code functional but with noticeable errors; little creativity.	No planning, research or testing done. Project does not work; Code partially functional, little to no technical effort shown.
3. Creativity & Design *(Neatness, Colors, Model Quality, Original Ideas)*	Design is highly creative, neat, colorful, and well-finished. Model shows original ideas and careful craftsmanship	Design is neat and colorful with good effort. Model is well-made with some creativity and clear ideas.	Design is simple; neatness or finishing may be uneven. Some creativity shown but model needs more detail.	Design is untidy or incomplete; little to no creativity visible. Model lacks structure or finishing.
4. Communication & Presentation *(Explaining the Project)*	Presentation is clear, engaging, and well-structured. Demo is delivered confidently.	Presentation is clear with understandable explanation. Demo works and reasoning is adequate.	Presentation is basic; explanations unclear or incomplete; demo may not work smoothly.	Unable to explain the project; no clear idea communicated.
5. Teamwork & Participation *(Only if group work)*	Actively collaborates; divides responsibilities fairly; supports teammates; solves problems together.	Works well with teammates; participates in most tasks.	Uneven participation; some teamwork challenges.	Does not participate or causes conflict.

SECTION 2: INNOVATORS (GRADES 3-6)

Theme: Sustainable Urban Farming

Students will explore the theme of sustainable urban farming by utilizing their choice of Smart IoT kits and Micro:bit technology.

ADVANTAGES

- *real-world problem-solving using sensors and smart systems*
- *environmental awareness through sustainable farming projects*
- *analytical skills by interpreting data (soil, light, climate)*
- *creativity with hands-on, culturally inspired activities*

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PROJECT 1:
SMART ECO-IRRIGATION SYSTEM

A mini smart farm using climate sensors + rainwater.

SENSORS

Soil moisture, light sensor (LDR), DHT11/22, rainfall sensor, water-level sensor

ACTUATOR Small pump

DISPLAY I2C LCD

LEARNING OUTCOME

- Soil science
- Sustainable irrigation
- Basic automation

FLOW

- Soil dry? → Check tank → If water present → Pump ON
- Tank empty? → Alert
- Rain detected? → Collect water
- Too hot or dark? → Display warning

SMART ECO-IRRIGATION:

PROJECT 2:
FOOD SPOILAGE DETECTOR

SENSORS CO_2/VOC + Temperature + Humidity

CONCEPT Spoiled food emits gas → detector alerts early.

OPTIMUM VALUES FOR FRESH FRUITS

- Temperature: 0–5 °C
- Humidity: 90–95% RH
- CO_2: 400–2,000 ppm (normal), >5,000 ppm = warning, >8,000 ppm = critical

LEARNING OUTCOMES:

- Early spoilage detection
- Reducing food wastage

PROJECT 3:

KOKEDAMA – JAPANESE MOSS BALL GARDENING

CONCEPT

Low-water decorative gardening.

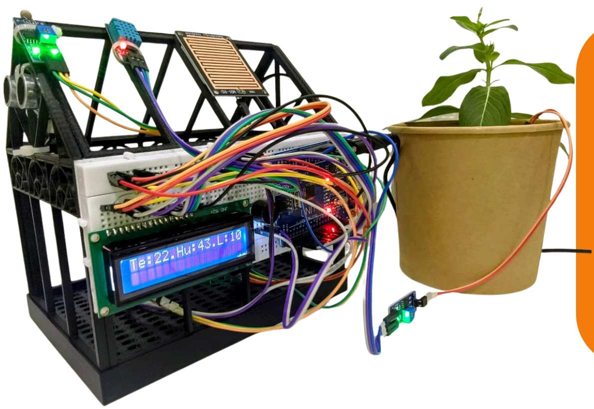
SKILLS

- Water conservation
- Cultural methods
- Hands-on plant care.

PROJECT 4:
SMART GREEN HOUSE

CONCEPT

A Smart Greenhouse that automatically monitors and optimises plant growth using five sensors and an LCD display to show real-time temperature, humidity, light levels, soil moisture, and plant distance.



SKILLS

- Sensor-based data interpretation
- Basic automation and problem-solving
- Coding and hardware integration

This Smart Greenhouse uses **five sensors**—temperature, humidity, light percentage, soil moisture, and distance—to collect real-time data. An LCD screen displays all readings clearly, while a buzzer alerts when conditions go beyond the desired range. Students learn how technology can support sustainable agriculture through automated monitoring and smart decision-making.

JUDGING CRITERIA

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3. AI Tools *(AI use)*	Uses AI tools purposefully (design ideas, optimization, documentation, testing).	Uses AI tools appropriately	Limited use of AI tools;	No use of AI tools
4. Communication & Presentation *(Explaining the Project)*	Presentation is clear, engaging, and well-structured. Research + data + demo is delivered confidently. Students strongly justify how their solution solves the problem.	Presentation is clear with understandable explanation. Demo works and reasoning is adequate.	Presentation is basic; explanations unclear or incomplete; demo may not work smoothly.	Unable to explain the project; no research; no clear idea communicated.
5. Teamwork & Participation *(Only if group work)*	Actively collaborates; divides responsibilities fairly; supports teammates; solves problems together.	Works well with teammates; participates in most tasks.	Uneven participation; some teamwork challenges.	Does not participate or causes conflict.

SECTION 3: CHALLENGERS (GRADES 7-12)

Theme: AI + Robotics for Agriculture

Young learners engage with robotics and AI, as well as machine learning and similar technologies, to create projects and functioning models that focus on food security.

ADVANTAGES

- *develops advanced skills in AI, IoT, automation, and agritech*
- *innovative thinking for global issues like food security*
- *future careers in STEM, robotics, and engineering*
- *teamwork through large-scale, multidisciplinary projects*

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PROJECT 1:

IOT SMART GREENHOUSE

Students build a climate-controlled greenhouse.

SENSORS

Soil moisture, DHT22, CO_2 sensor, UV/light sensor

ACTUATORS

Pump, fan/exhaust, LED grow lights

IOT FEATURES

- Live data (soil %, temp, humidity, CO_2, light)
- Alerts (overheat, dry soil)
- Remote ON/OFF control

AUTOMATION RULES

- Soil low → Pump ON
- Temp high → Fan ON
- Light low → LEDs ON
- CO_2 high → Ventilation ON

Outputs:

- IoT
- Climate control farming
- Real-world agriculture challenges

PROJECT 2:

AI CROP HEALTH & GROWTH MONITORING

Hardware: OpenMV / ESP32-CAM / Pi Camera + IoT module

AI FUNCTIONS:

- Detect pests, disease spots
- Track growth (leaf size, greenness)
- Predict yield
- Send alerts

Learning Outcomes

- AI model basics
- Computer vision
- Precision farming

PROJECT 3:

WIND-POWERED IRRIGATION & SMART FARM MODEL

Students combine renewable energy + sensors.

COMPONENTS

Mini wind turbine, water pump, relay, IoT sensors, LCD display.

Outputs:

- Wind-powered pump
- Auto irrigation
- Sensor-based farm control

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3. AI Tools & Financial Thinking *(AI use, Budget, Efficiency)*	Uses AI tools purposefully (design ideas, optimization, documentation, testing). Thoughtful financial planning — cost comparison, resource efficiency, sustainability.	Uses AI tools appropriately; basic cost/budget considerations included.	Limited use of AI tools; financial aspect unclear or incomplete.	No use of AI tools; no financial planning.
4. Communication & Presentation *(Explaining the Project)*	Presentation is clear, engaging, and well-structured. Research + data + demo is delivered confidently. Students strongly justify how their solution solves the problem.	Presentation is clear with understandable explanation. Demo works and reasoning is adequate.	Presentation is basic; explanations unclear or incomplete; demo may not work smoothly.	Unable to explain the project; no research; no clear idea communicated.
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JUDGING CRITERIA

Evaluation Categories

Category	Score Range (out of 100)	Description
Outstanding	**90-100**	Exceptional performance across nearly all criteria; project is polished, innovative, and highly effective.
Excellent	**75-89**	Strong performance with minor gaps; project is reliable, clear, and well-presented.
Good	**50-74**	Adequate performance; project works but has noticeable weaknesses in quality, clarity, or delivery.
Developing	**0-49**	Performance still developing; project incomplete or inconsistent; significant improvement needed.

APPENDIX

WIND TURBINES & FOOD SECURITY (QUICK REFERENCE)

WIND-POWERED IRRIGATION

Turbine powers pump → soil moisture sensor triggers watering.

WIND-POWERED COLD STORAGE

Keeps produce fresh in remote/rural areas.

WIND-POWERED GRAIN PROCESSING

Grain mill simulation using fan power.

OFF-GRID SMART FARMING

Wind + solar hybrid → runs sensors, irrigation, AI camera.

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