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20TH AUGUST 2025

TRANSFORMING EDUCATION, DRIVING INNOVATION AND
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GLOWSAFE LUNCHBOX: AN EARLY-WARNING INNOVATION FOR FOOD SAFETY IN SCHOOLCHILDREN

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ABSTRACT

The GlowSafe Lunchbox is a student-led innovation aimed at addressing food safety issues among schoolchildren. The device uses a saltwater-dried strip connected to a basic electrical circuit to detect the presence of unwanted moisture in a lunchbox, often a sign of leaking or spoiled food. When moisture is present, it completes the circuit and triggers a warning light. This extended abstract presents the rationale, methodology, findings, and implications of the GlowSafe Lunchbox project, which emphasizes early detection and low-cost design. Data were collected by testing various food items under controlled conditions. Results show consistent light activation with common moist foods, demonstrating its value as a practical early-warning tool. The study concludes that the GlowSafe Lunchbox offers a simple yet effective solution for enhancing food safety awareness in children.

Keywords: *food safety, early warning system, moisture detection, low-cost design, school children*

INTRODUCTION

Foodborne illnesses among children often arise from improper storage or spoiled food in lunchboxes. These risks are difficult to detect early, particularly for younger children who may not recognize signs of food spoilage. This concern is evident in Malaysia where the food poisoning incidence in schools reached **50.90 per 100,000 population** in 2019, and half of foodborne disease outbreaks have historically occurred in institutional settings such as schools (Salini Devi Rajendran, 2024; Soon-Sinclair & Singh, 2011). The GlowSafe Lunchbox was developed to address this issue by providing a visual alert when moisture—often linked to spoilage—is detected inside the container. Unlike chemical test kits or advanced sensors, this model uses a simple, low-cost mechanism that is both educational and practical for school use.

METHODOLOGY

The GlowSafe Lunchbox integrates two compartments: one for food and another housing a saltwater-dried paper strip connected via crocodile clips to a battery-powered LED. A small channel allows any leaking moisture from food to flow into the sensor compartment. When moisture reactivates the salt, it facilitates electrical conductivity and completes the circuit, lighting the LED. The device was tested with various food samples (fresh and spoiled), including rice, curry, and milk. Observations were recorded based on LED response. This low-cost, easily understandable moisture-based detection mechanism is especially important in the Malaysian context, where foodborne illnesses linked to improper handling in schools have been a persistent concern, with the Ministry of Health reporting that food poisoning cases remain among the most common communicable diseases in educational institutions (Ministry of Health Malaysia, 2020).

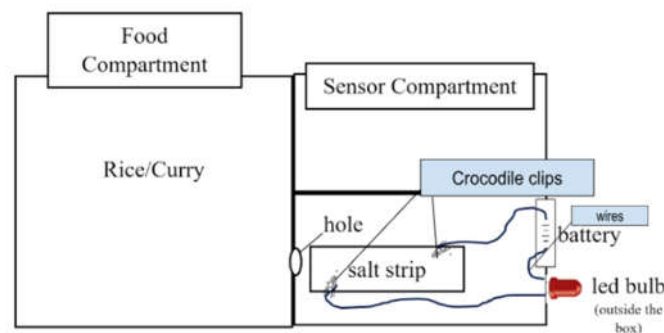


Figure 1: GlowSafe Lunchbox Setup (schematic representation of the moisture sensor circuit)

Table 1: LED Response to Food Samples with Varying Moisture Levels

Food Sample	Condition	LED Response
Rice	Dry	No Light
Rice	Moist (Fresh)	Light On
Curry	Fresh	Light On
Milk	Fresh	Light On
Milk	Spoiled	Light On

RESULTS AND DISCUSSION

Testing confirmed that any moist or leaking food—regardless of whether it was spoiled—was sufficient to trigger the LED. This is because the dried salt strip, once rehydrated by moisture, becomes conductive. While the system does not directly detect spoilage, the presence of unexpected moisture in a sealed container strongly correlates with leakage or potential bacterial activity. Importantly, This early-warning feature aligns with the World Health Organization’s (WHO) emphasis on preventive measures to reduce foodborne illnesses, particularly among vulnerable groups such as children.WHO (2024) highlights that unsafe food containing harmful bacteria, viruses, or chemical substances causes more than 200 diseases globally, with young children being at the highest risk. In this context, the GlowSafe Lunchbox provides a practical low-cost school-based solution that supports WHO’s call for safe food practices and early detection mechanisms to protect children’s health.Table 1 presents LED responses for various samples. Figure 1 shows the internal setup of the GlowSafe Lunchbox with sensor wiring.

Table 2.: Observed Moisture Levels and Activation Time

Food Item	Moisture Level	LED Activation Time
Dry Bread	Low	No Light
Cooked Rice	Medium	3 seconds
Curry	High	1 second
Milk (Fresh)	High	1 second
Milk (Spoiled)	High	1 second

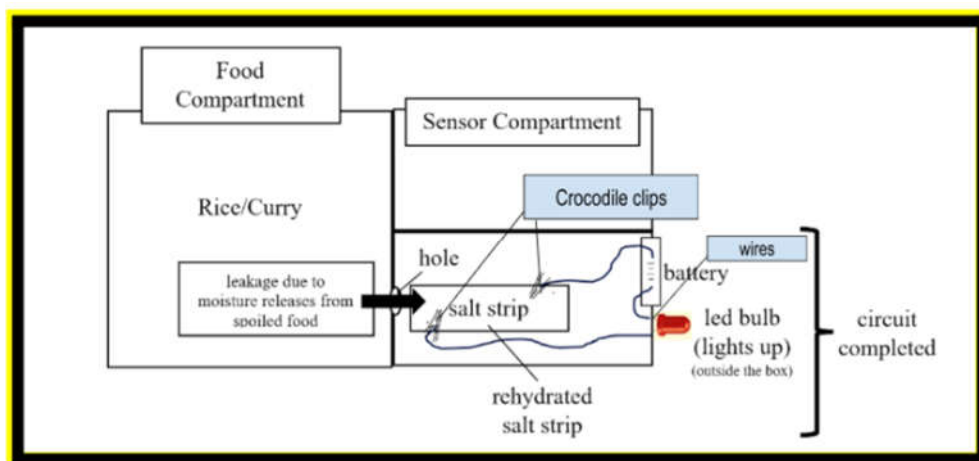


Figure 2: Conceptual Diagram – Moisture flow through compartment to trigger salt strip circuit

CONCLUSION

The GlowSafe Lunchbox demonstrates a functional, low-cost method to promote food safety awareness among primary students. Its simplicity and practicality make it suitable for school environments. Although it does not detect spoilage directly, its ability to indicate the presence of moisture offers a proactive warning to prevent consumption of potentially unsafe food.

ACKNOWLEDGEMENTS

The research team gratefully acknowledges the support and guidance provided by our science teacher, school administration, and our parents, who encouraged our participation in this innovation project. Special thanks to SUSED2025 for the opportunity to present our work.

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